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**THE PSYCHOLOGY OF
LEARNING AND TEACHING**

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THE PSYCHOLOGY OF LEARNING AND TEACHING

A NEW CONTRIBUTION TO THE SUBJECT
IN THE FORM OF A THREE-PHASE THEORY

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INTRODUCTION

MR PERERA in his previous book *The Essentials of Teaching* showed that a careful study of the process of learning revealed certain well-established Laws of Learning. In the present volume he shows that correct teaching methods are a natural consequence from the phases of learning. He never loses sight of the fact that sound teaching must go *pari passu* with the learning process. In this way his whole argument and classification of teaching devices is based on a sound psychological foundation.

While he classifies teaching into phases and modes this classification is not rigid. The nature of his subject forbids a rigid classification. So he contents himself by singling out the main phases and modes, pointing out which of these are crucial in certain types of knowledge. These he illustrates profusely with examples which show an intimate practical knowledge with the subject about which he writes.

There is no doubt that the real application of knowledge is the ultimate aim of the teaching in our schools and however difficult it may be to get away from old conceptions and standards this principle must penetrate our educational leaders if any progress is to be made.

The effort made to steer a middle course between traditional ideas and the modernist school of thought is not only praiseworthy but is done with a success not to be found in other textbooks on this subject. I heartily commend Mr Perera's treatise to all serious students of education.

L. MACRAE

PREFACE

IN a book of this kind I am naturally under obligation to a large number of writers on psychology and education. I have named several in the text; to them and to those whom I have not been able to name I here express my thanks.

I am under special obligation to Professor C. Spearman, of whose psychology this is an application.

I wish to thank the following for much encouragement and helpful criticism:—Mr L. Macrae, M.A., Dr Harold E. Palmer, Mr L. McD. Robison, B.A., Mr S. Shivapadasunderam, B.A., Mr S. K. Rajasingham, B.A., and Dr Shivaprakasam.

I desire to express my thanks to the following colleagues, who helped in the preparation of practical applications of the Three-Phase Theory explained in this book:—Mr J. Bleakley, M.Sc., Mr. E. C. T. Holsinger, B.Sc., Mr S. F. de Silva, B.A., Mr R. A. Kriekenbeek, Mr T. U. de Silva and Miss N. G. Perera.

In the preparation of the typescript and of the index I was greatly helped by Messrs A. W. Kaluaratchi and H. R. H. de Silva. To them also I express my thanks.

Colombo
August 1937

H. S. PERERA

WORD FOREWORD FOREWORD FORE

Mode suggests a combination of devices with one particular device playing a dominant part. For the rest I refer the reader to Mr Perera's own exposition of the subject.

5. The distinction between *Drill* and *Habitual Application*. It is under this heading that the author points out the respective places of repetition and systematizing. Each plays its part in the complete method, and neither side should be neglected.

6. The last of the points that have particularly attracted my attention should perhaps have been mentioned first, namely, that all educational activities have a threefold form, *knowing, feeling and doing*. Now in the field of linguistics there has been going on a sort of conflict between (a) those who are chiefly interested in teaching the facts of language, (b) those who see as the centre of linguistic activities the literary tradition, appreciation and self-expression, and (c) those who are aiming above all at proficiency in using the foreign language in the manner of those to whom it is the mother-tongue—'as speech' as the de Saussure doctrine puts it. The author makes it clear in the course of his exposition that these are not three rival or conflicting doctrines but merely three 'modes' in which knowing, feeling, and doing are respectively the dominant features. The grammarian and lexicologist naturally stress the 'knowing', those who look upon language as part of the 'humanities' stress the 'feeling' side, and those who advocate what is known as the Reform Method envisage particularly the 'doing' aspect. For Mr Perera the *langue* and *parole* distinction made by de Saussure is nothing other than the 'knowing' and 'doing' aspects of education in general,

and whatever conflict there may be between the teachers of language and the teachers of literature is nothing other than a respective stressing (or over-stressing) of the parts played respectively by the 'feeling' aspect and the 'knowing-doing' aspect.

In conclusion and summary I would say that the theory of learning set forth by the author is the only one that I know into which can be fitted every one of the various conflicting doctrines of the exponents of linguistic pedagogy.

HAROLD E. PALMER

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CHAPTER I

INTRODUCTORY

Learning : its aim

THE acquisition of abilities, which enable us to adjust ourselves in an effective manner to the environment and to control it successfully, may be said to be the aim of learning. To take some examples, the rustic who has had no school education and who is unable to read and write, adapts himself less successfully to his environment than the more fortunate person who has acquired these abilities. Again, the person who has not learned to appreciate literature, music and art is less successful in enjoying the refinements of life than one who is conversant with those gifts of civilization. Similarly if a man has not learnt the art of living harmoniously with others, he will find life more beset with difficulties than the person who has succeeded in learning how to establish social relations with his fellows.

Abilities

In the history of evolution, adjustment to the environment took place in the animal world through the development of organs suitable for dealing with it. The ancestor of the horse, a defenceless creature living on the prairies, developed organs suitable for quick movement. In the human world adjustment takes place not so much through the development of organs as

through the development of abilities, such as the abilities for reading and for writing.

Effective abilities

An ability is of little value unless it enables us to adjust ourselves in an effective manner to our environment. Thus ability to read English, or whatever the foreign language may be, if it does not enable us to read real English books but only 'readers' would be an example of an ability which has not reached an efficient stage. Similarly, if our ability at arithmetic is limited to the ability to solve the formal problems of the school, our arithmetical ability would not be a really effective ability. In the same way, if we can only play musical exercises but not real pieces, we would have only an ineffective ability.

Learning is the process by which we acquire abilities, and it is most successful when it gives us abilities which enable us to deal efficiently with real life situations.

When and where learning takes place

Learning in this sense is evidently not limited to the school. It begins long before and may continue long after schooldays. Thus acquiring the ability to speak the mother-tongue begins very early in infancy. On the other hand the ability to practise a profession, such as that of a judge, is acquired after leaving school. The art of walking is learnt before one comes to school, but the art of travelling has usually to await maturity. How to behave towards the members of one's family is learnt at home but how to behave as a member of

society is largely learnt in the school of adult experience.

Two classes of abilities

All the abilities we acquire, whether at school or outside, may be divided into two classes. By means of one class of abilities we deal with accustomed situations. These may be called habitual abilities. By means of the other class we control novel situations. These may be called constructive abilities.

Habitual abilities

To the first class of abilities belong skill, appreciation and comprehension. By the acquisition of skill we know what to do in familiar situations. The skilled woodcutter knows how to split wood with his axe. The skilled chauffeur knows how to drive a car. The skilled farmer knows how to plough his land, sow the seed and reap the harvest in the usual manner. By acquiring habits of appreciation we learn to value virtue in conduct, and beauty in music and art. The honest man has acquired the ability to value honesty. The musician knows how to value beauty in music, and the artist is able to see beauty in art. It is when we turn to comprehension that it is difficult for us to realize that our ways of comprehending the world are due to abilities that we have acquired. We now comprehend the world as consisting of familiar objects such as houses, plants and animals, but we cannot be supposed to have done so from the moment we entered the world. These are abilities that we had to acquire but which we now use in

a subconscious manner. Habitual abilities of all these kinds enable us to live successfully in an unchanging environment but society desires constructive abilities too, for without them there would be no progress.

Constructive abilities

To the class of constructive abilities belong invention, creation and discovery. Invention enables us to react in novel ways to our surroundings. Of the more recent inventions the motor car makes it possible for us to move swiftly on land; the steamer enables us to cross the seas with speed and comfort and the aeroplane has bridged distances in an incredible manner. Creation is like invention, but its field is that of feeling and appreciation. The creation of new objects for appreciation increases the range of objects of value. The chief values such as honesty and justice were created long ago by the great men of the race but the process of creating new values can still be seen at the present day. Germany, Russia and Italy have lately created new values. A Hitlerite in Germany esteems hatred of Jews, a Communist in Russia appreciates state-ownership of capital, while a Fascist in Italy rates highly the virtues that characterized the ancient Romans. Creation in music and art is much more common than the creation of virtues, and is of daily occurrence in the more advanced countries of the world. It may be said without exaggeration that the world is daily creating hundreds of new songs and pictures. Discovery no less than creation and invention is going on apace. Scientists are continually discovering for us new ways of compre-

hending the world. The chemist shows us the marvellous constitution of substances. The botanist introduces us to the mysteries of plants, while the physiologist reveals unsuspected functions of living things.

Relation of abilities to our nature

There is an intimate connexion between the abilities we have discussed and our nature. It is generally accepted that we are beings capable of knowing, feeling and doing. To knowing belong such activities as seeing, hearing and understanding; to feeling, such states as pleasure, anger and sorrow; to doing, such activities as cooking, writing and house-building. If we examine the abilities that learning gives, we shall find that they correspond to this classification. Skill and invention concern doing, appreciation and creation belong to feeling while comprehension and discovery are processes of knowing. Each aspect of our nature gives rise to both habitual and original abilities. Comprehension, for example, is the more passive ability while discovery is the more active ability connected with the knowing or cognitive aspect of our nature.

The following table will show more clearly the relation between our nature and our abilities.

<i>Our Nature</i>	<i>Habitual Abilities</i>	<i>Constructive Abilities</i>
knowing	comprehension	discovery
feeling	appreciation	creation
doing	skill	invention

Abilities given by schools

If these are the chief abilities that learning gives, it will be interesting to compare them with the abilities

that schools actually give. In primary schools pupils acquire skill in language, number and handwork, and in post-primary schools a wider comprehension of the world through geography, history and science. In the more advanced schools some real appreciation of literature, art and music is also taught. But these are all habitual abilities. It is only in the experimental schools, such as those that have adopted the Project Method, that the constructive abilities receive adequate attention. It is only in them that pupils are encouraged to invent, create and discover. The Project Method schools specially encourage invention. In them pupils learn how to do new things. Schools, like those of Caldwell Cook, which use the Play Way have proved that even young children can compose very beautiful poems. In Heuristic schools pupils learn how to discover. That all pupils require a large share of habitual abilities is obvious but it is not so obvious that the majority of pupils are also capable of developing constructive abilities in some degree or other.

The meaning of learning may now be summed up in the following sentences. It is the process by which we acquire abilities helpful to us in real life situations. It is the process which enables us to deal with habitual situations or to grapple with changing civilization. It is also the process which makes it possible for us, if we desire it, to develop all the sides of our nature in a balanced and harmonious manner.

The aim of this book

The aim of this book is to study how the learner

acquires abilities with the help of a teacher, and how the teacher may help the learner. Such an analysis should enable the teacher to comprehend intelligently the process of learning and to proceed in his work in a scientific rather than an empirical manner. He will then tend to become a truly professional man conversant with principles and able to apply them, not a person who merely relies on rule of thumb methods, having no truly scientific background.

Analysis of learning

We shall begin by analysing learning into its three essential phases, namely, the acquisition, fixation and application of knowledge. We shall then consider the modes of learning appropriate to each phase. It will be shown that the chief modes of acquiring knowledge are experience, communication and investigation, and that each mode is characterized by a crucial process, and that the chief crucial processes discovered by psychologists are apprehension of the character of experience, acceptance of communications and education of knowledge. It will also appear that the chief modes of fixing knowledge are drill and review, the crucial processes being repetition and organization. Modes of application will be shown to be two in number, namely, formal application and real application involving the practice of formal and real actions.

This brief outline of the learning process, which can only give the reader a very general idea of the process, will later be discussed in detail in this book. Its main features, however, may be exhibited in diagrammatic form as follows:

LEARNING

*Phases**Modes**Crucial Processes*

1. Acquisition of knowledge.	(i) Experience.	(i) Apprehension of experience.
	(ii) Communication.	(ii) Acceptance of communications.
	(iii) Investigation.	(iii) Education of knowledge.
2. Fixation of knowledge.	(i) Drill.	(i) Repetition.
	(ii) Review.	(ii) Organization.
3. Application of knowledge.	(i) Formal application.	(i) Practice of formal actions.
	(ii) Real application.	(ii) Practice of real actions.

Analysis of teaching

After analysing learning, we shall proceed to the analysis of teaching which consists in directing and helping the learning process. Such an analysis will show that there are phases, modes and crucial processes of teaching corresponding to those of learning. They may be diagrammatically shown as follows :

TEACHING

*Phases**Modes**Crucial Processes*

1. Helping acquisition of knowledge.	(i) Demonstration.	(i) Showing.
	(ii) Talk or Lecture.	(ii) Telling.
	(iii) Discussion.	(iii) Questioning.
2. Helping fixation.	(i) Drill.	(i) Fact questions.
	(ii) Review.	(ii) Thought questions.
3. Helping application.	(i) Formal application.	(i) Practice and correction of formal exercises.
	(ii) Real application.	(ii) Practice and correction of real exercises.

This outline, which will later be developed in detail, will show that there is practically a point to point correspondence between learning and teaching. No satisfactory theory of teaching can be built up which does not take as its foundation the learning process. It should also be mentioned that the learning we are concerned with in this book is human learning, particularly that part of it which is of special interest to the teacher.

QUESTIONS AND EXERCISES

In order to comprehend more fully the chapter already read, the reader is advised to study the following questions and exercises. The same type of question and exercise will be repeated at the end of subsequent chapters.

Enumeration Tests

1. Name the chief kinds of abilities.
2. Name the sides of our nature.
3. Name the abilities most cultivated in schools.
4. What is the ultimate aim of learning?
5. Name the constructive abilities.
6. Name the habitual abilities.

Completion Tests

1. Learning is not limited to the
2. By we deal with familiar situations.
3. By we deal with novel situations.
4. New values are being created in and
5. Ordinary farmers have abilities.
6. Scientists have discovered new ways of the world.

Right or Wrong Tests

Decide whether each statement is true or false :

1. Originality cannot be taught.
2. Literature should not merely be understood but also appreciated.

3. Comprehension of the world begins at school.
4. Explorers are discoverers.
5. New values are not now created.
6. We should aim at acquiring both habitual and constructive abilities.

ADDITIONAL QUESTIONS

1. Is teaching a profession? Why? What are the essentials of a profession?
2. It has been claimed that education should provide for the harmonious development of all the powers. Criticize this statement.
3. How do you account for the fact that many children almost cease to inquire, to investigate or even to ask questions?
4. What justification is there for music, drawing or literature in the curriculum?
5. State briefly the aim of this book.

CHAPTER II

THE PHASES AND STEPS OF LEARNING

WE shall begin our study of the learning process by distinguishing its principal phases. We shall next consider whether these phases occur simultaneously or in succession and then try to gain some idea of the nature of each phase.

Phases

If we believe that the result of learning is the ability to use knowledge, it follows that knowledge must first be acquired and retained before it can be used. Three phases may, therefore, be distinguished in any complete act of learning. They are:

1. Acquisition of knowledge.
2. Fixation of knowledge.
3. Application of knowledge.

The successful learning of any simple fact like $3 \times 3 = 9$ involves all three phases. The pupil must first understand that $3 \times 3 = 9$. He must then fix it in his mind so as to be able to reproduce it. Finally, he must be able to apply it to some real situation. All three phases are essential. If the first phase fails to occur successfully, he will not be able to proceed any further as he will have no knowledge; he will only be able to repeat the words $3 \times 3 = 9$ in a meaningless way like a parrot. If the second phase fails and the pupil is unable to recall the

fact that $3 \times 3 = 9$, he will not be able to reach the next phase. The third phase is in a sense the most important of all since it implies, as will be shown later, real use of knowledge. If in real life the pupil has occasion to buy three articles at three shillings each, he must be able to apply his knowledge and arrive at the total cost without hesitation and without error, thus adjusting himself successfully to the situation.

Again, suppose a pupil has to learn the correct pronunciation of the word 'conduct' both as a noun and as a verb. Here also complete learning implies three phases. The first phase consists in his coming to know among other things how to put the accent on the first syllable when the word 'conduct' is used as a noun and how to put it on the second syllable when it is used as a verb. The second phase should enable him to fix this knowledge in his mind so as to be able to reproduce it correctly. To ensure this some repetition in the form of drill may be essential. The last phase of learning is not completed until the pupil is able to use his knowledge correctly and without hesitation when real situations give him occasion to use the word in such sentences as: 'My conduct was not questioned.' 'I conducted the meeting.' 'He was pleased with my conduct.' 'How did he conduct himself on that occasion?'

The examples so far given have been from arithmetic and language. We might now take an example from geography. Suppose the topic is the Mediterranean type of climate. The pupil has first to understand that this type of climate is characterized by wet winters and warm rainless summers, and that it suits the growth of

many kinds of fruit, such as oranges and figs, which are well ripened in the warm, rainless summers. During the second phase of learning he has to make sure of these facts by reviewing them. He would have completed the third phase of learning only if, for example, on hearing of another country with wet winters and warm rainless summers he is also able to comprehend it as likely to have many kinds of fruit, such as oranges and figs. If mention of countries with wet winters and warm rainless summers produces no such reaction in him, his learning would be like that of a parrot and would not have gone beyond the second phase.

Steps of learning

We have purposely spoken of phases rather than steps of learning. This is because all learning does not take place in distinguishable temporal steps. If we represent the phases of learning by the letters A, B. and C, then we can distinguish the following combinations:

- | | | |
|-------------------------|------------------------|--------|
| 1. One-step learning. | A, B and C together. | ABC. |
| 2. Two-step learning. | A followed by B and C. | A—BC. |
| | or | |
| | AB followed by C. | AB—C. |
| 3. Three-step learning. | A, B and C separate. | A—B—C. |

All these combinations occur in actual life. We shall proceed to illustrate them.

In one-step learning all the phases occur more or less together. Thus when a child learns to walk, he begins at once by trying to walk. While doing this he acquires knowledge, retains it and makes use of it to improve his walking. All this, of course, is done more or less

subconsciously. The same process is gone through more consciously when one learns to ride a bicycle. Swimming is an example of another ability which is usually acquired by one-step learning.

As an example of the first kind of two-step learning in which the acquisition of knowledge forms a distinct step, we may take the case of learning a new game. The game of Pass Ball, for instance, may be explained by someone who points out the chief differences between this game and Net Ball and the rules that govern the former game. This will be followed by practice of the game during which knowledge will be fixed and expertness in correct application gained. The second kind of two-step learning in which application forms a separate step may be illustrated from the teaching of appreciation. A poem, for instance, has to be presented in the best possible manner several times before its beauties can be fully appreciated. By the time the pupil has appreciated most of the merits of the poem, he will have become so practised in appreciation of poems of this type that a separate step of fixation should be unnecessary. Application, however, which in this case will consist in trying to appreciate a similar poem can follow as a separate step.

Three-step learning in which knowledge is first acquired, then fixed and finally applied is common in connexion with informational subjects. When we wish to learn the causes and results of the French Revolution, we can acquire the necessary knowledge by reading books, and then fix it by reviewing the material without looking at the books and finally practise application by trying to

solve problems, which require this knowledge for their solution, with a view to real use of the knowledge acquired.

The acquisition of knowledge

We shall now examine briefly the nature of each phase of learning, beginning with the acquisition of knowledge. The term knowledge is here used in its broadest sense to include knowledge of all our experiences, whether conscious or subconscious. When we say we know that $3 \times 3 = 9$, we are conscious of this knowledge but when we say we know how to play tennis our knowledge is chiefly subconscious. We can explain to any one fully the fact that $3 \times 3 = 9$ but we shall be able to explain only in a very general manner how we play tennis. When we say we know that we appreciate a poem, this does not usually mean that we are consciously aware of all that happens in appreciation. Human learning begins with more or less awareness of a change in mental experience. This awareness when explicit is conscious knowledge, when implicit subconscious knowledge.

Interpretation and supplementation

The growth of knowledge is usually in two stages, a stage of interpretation followed by a stage of supplementation effected through explanation. *When any new object is presented to us, we at once attempt to interpret it with the aid of past experience.* When the savages first saw Captain Cook's horses, they at once interpreted them as pigs. A savage would regard an aeroplane as a bird. A little child may call all men 'father'. Full

comprehension requires a supplementation through recognition of differences. For Captain Cook's savages to have understood horses, they would have had to go beyond the stage of interpretation and understand the differences between horses and pigs. The savage will make a beginning in understanding aeroplanes when he sees that they are not living things like birds. A child's wrong interpretation of other men as 'father' is corrected only when he understands the difference between them and his own father. The stages in the growth of knowledge, namely, interpretation and supplementation through explanation, are of great importance to the teacher and adequate knowledge of them will be assumed in the following chapters. For fuller information in regard to them the reader is referred to the writer's earlier book *The Essentials of Teaching*.¹

We should now examine the various means by which knowledge is acquired, namely experience, communication and investigation; but as this is a very large subject we shall postpone it to succeeding chapters and, instead, examine in this chapter the two remaining phases of learning.

Fixation of knowledge

The second phase of learning is the fixing of knowledge so as to ensure reproduction. The two main modes of reproduction were distinguished very early by the Greek philosopher, Plato. These are reproduction by contiguity and reproduction by similarity. The following are exam-

¹ Longmans, Green and Co. Ltd., 1932.

ples of the first mode: 3×3 recalls 9 with which it had been earlier associated. A word recalls the meaning to which it has been attached. The scene of an accident reminds one of the accident. The words 'Mediterranean type of climate' tend to recall the words 'wet winters and warm rainless summers'. The idea of the noun 'conduct' reminds one of where the accent should be. We may illustrate the second mode of reproduction as follows: we may recall a friend on seeing someone who resembles him; the full moon may remind us of a football, and crested breakers of galloping horses. It is by this process that we are usually reminded of rules. A problem under consideration reminds us of a particular rule because it is in some respects similar to the examples from which the rule was derived.

Repetition and organization

To ensure reproduction of isolated items repetition is normally essential. Very vivid experiences require no repetition but ordinary experiences require it. The first day of school and the first visit to the theatre are easily remembered because they were vivid experiences, but the facts of the multiplication table require many repetitions. To facilitate reproduction of connected and meaningful material, organization is what is most necessary. The pupil who has organized his knowledge of geography finds it quite easy to add to his store of reproducible knowledge because new facts find their proper place in his system. Organizing takes place through the finding of relations. That such finding of relations helps reproduction can be proved by the following experiment. The reader should

attempt to memorize the two lists given below. In the first he will find it difficult to find any relations but in the second list he will find each word related to the next. If he succeeds in finding these relations, he will find that he has at the same time memorized List 2.

List 1

woman
window
money
book
servant
gold
carpenter
page
ornament
house

List 2

book
page
servant
house
window
carpenter
money
gold
ornament
woman

Application of knowledge: real and formal applications

The last phase of learning ends in what we are going to term 'real' application; but there is another mode of application much used in school. It may be called 'formal' application. Its function is to prepare for real application. Now let us see what we mean by these two terms 'real' and 'formal'.

Most school exercises are formal applications. For instance in arithmetic after a rule is explained, the pupil practises a number of examples either orally or on paper. These are valuable exercises because they fix the rule in the mind of the pupil and give him a certain speed and dexterity in its use. However valuable these exercises are, they directly aim at preparing the pupil for real

application afterwards. They are therefore formal applications. If the exercise has some other aim such as occurs in real life, with or without the aim of preparation, it is then a real application. Real applications used in school generally involve the formal function too. Measuring a tennis court for the sole purpose of improving one's power of measuring is a formal application, while doing the same for building a tennis court for the school is a real application. If the pupil practises how to write letters, he is doing formal exercises ; but if he writes a letter challenging another class to a cricket match, his application is more than formal and is real since it includes a purpose other than the improvement of his abilities by way of preparation.

The essential condition of real application is that the action should be designed for more than the preparation of the pupil for future real application, that is, it must involve some purpose other than mere self-improvement. Situations that involve more than preparation are called real life situations or natural situations in contrast with school situations especially designed for preparing the pupil for real application. These situations are called artificial situations when they are compared with the natural life situations in which real applications occur.

Situations that require application may arise on account of external circumstances or on account of internal interests. The following are examples of situations arising from external circumstances: writing a letter of thanks for a gift received ; making an arithmetical calculation when buying an article ; using geographical information for understanding the foreign news section

of a newspaper. Examples of situations arising from internal interests are as follows: writing a letter to a friend because we wish to keep in touch with him; writing a book of mathematics for the benefit of teachers; making a geographical survey of a village for publication in a school journal. External circumstances bring us opportunities for application. Internal interests impel us to seek out opportunities for application. The more interested we are, the more opportunities we shall have for application, both formal and real. The examples given above are examples of real applications but the same actions if done solely for the purpose of preparing for real life applications will become formal applications.

In real life many situations naturally arise when real applications become necessary. In schools whose special purpose is the improvement of the pupil's abilities, all applications tend to be formal; but this procedure creates a gulf between the real applications of real life and the formal applications of the school. This gulf is bridged by introducing real applications into the school and combining with them, wherever possible, the purpose of self-improvement. Thus the real applications of the school will differ from those of real life by having self-improvement also as an aim.

Classes of real applications

It is a mistake to suppose that real applications are limited to practical activities, that is, dealings with material things. Applications that involve the use of material things, such as making chairs and carrying out,

agricultural activities, appear at first glance to be the only real applications, and many teachers think that no application is real unless it involves the use of material things. This mistake is due to confusing the various meanings of the word real. With reference to things it means, material'; with reference to applications it means natural applications as opposed to the artificial applications of the school. School applications are regarded as artificial because they aim solely at the improvement of abilities. Making chairs and carrying out agricultural activities will become real applications only if they also involve some purpose other than the improvement of the abilities of the pupil. That activities should resemble real life activities is not enough. They must be actual real life activities. Arithmetical exercises such as weighing articles in the classroom and measuring the area of the classroom and the school playground resemble real life activities, but they will not be real applications unless there is also some purpose other than the improvement of the pupil. Practical activities, however, form one class of real applications when they involve real life purposes. These may be regarded as the first class of real applications.

The second class of real applications involves the use of intellectual abilities. Our purpose in these is to gain further knowledge of the objects of the real world, not to make any practical alteration in them. Comprehension of things and persons with whom we come in contact or about whom we think, involves real application when we do so for some real purpose. So does the discovery of new things about them.

The classes of real applications are not yet complete. There is still another class in which our reaction is not by physical activity or by thought but by feeling. To this class belong æsthetic and moral appreciation and creation. Here what we value and enjoy are æsthetic and moral objects. These applications also become real only if they are carried out in such a way as to give real enjoyment and not merely a preparation for such enjoyment.

Habitual and constructive applications

Application is using acquired knowledge for meeting situations. When the situation is similar to a past situation, then the application itself is a more or less accustomed reaction. These may be called habitual applications and imply the formation of the abilities that were called, in the first chapter, habitual abilities. Examples of habitual applications are the following: adding a column of figures in the usual manner; making a box of a familiar type; appreciating a poem similar to one already appreciated; expressing appreciation of an act of service with the customary 'thank you'; comprehending the world in the usual manner as consisting of houses, plants, animals, etc.; comprehending California as belonging to the Mediterranean type of climate.

In habitual application the process is very simple. The new situation reproduces by similarity some rule or system of ideas; for example, the method of adding or the facts about the Mediterranean type of climate. The rule or system of ideas is then applied with necessary adaptations to the situation.

In addition to habitual applications there are constructive applications. By these we meet new situations in new or unaccustomed ways. The following examples may be considered: the invention of a new type of box; the invention of a new way of working a sum; creating or composing a new song; creating a new design or painting a new picture; discovering the form of a flower, the stages of growth of a plant or a principle in physics:

Summary

Three phases may be distinguished in the process of learning,—acquisition, fixation and application of knowledge. Various combinations of these phases give rise to one-step, two-step and three-step learning. Knowledge is acquired through experience, communication and investigation. Fixation is accomplished by repetition and organization. Formal applications prepare for real applications and each of these may be either habitual or constructive according to whether the situations are familiar or new. Formal applications aim solely at the improvement of abilities, while real applications are characterized by the presence of real purposes; that is, purposes other than that of preparation for real life application.

QUESTIONS AND EXERCISES

Enumeration

1. Name the phases of learning.
2. Name the differences between habitual and constructive applications.
3. Name three kinds of constructive applications.
4. Name three kinds of habitual applications.
5. Name two differences between formal and real applications.
6. Name the two kinds of reproduction.

Completion

1. True learning must end in . . . to . . . life.
2. When the new situation is similar to a past situation, the application itself is an . . . reaction.
3. 'Creations' are such things as . . . and works of art.
4. The aeroplane and radio are examples of . . . application.
5. Before knowledge can be applied to real life, it must be . . . and . . .

Right or Wrong?

1. Application is the last phase of learning.
2. Application always implies a novel situation.
3. Discovery is one variety of constructive application.
4. Habitual applications are always formal.
5. There are no phases in the acquisition of abilities.

ADDITIONAL QUESTIONS

1. What are the characteristics of real application?
2. Under what conditions is repetition most necessary?
3. Illustrate the different kinds of reproduction.
4. Illustrate the stages of acquiring knowledge.
5. Illustrate the phases of complete learning.
6. Give examples of one-step, two-step and three-step learning.
7. Distinguish between drill and the use of knowledge.
8. Give examples of formal exercises.
9. Of what use is knowledge? What is the fallacy of teaching it as an end in itself?
10. Give examples from experience of ineffective learning due to stopping at the stage of understanding.

CHAPTER III

THE MODES OF ACQUIRING KNOWLEDGE

IN the previous chapter we noted that the process of acquiring knowledge passes through two stages, namely, (a) interpretation with the help of past experience and (b) supplementation, enabling us to understand what baffles our attempts at interpretation. Captain Cook's savages interpreted horses as pigs until they were told, or they found out for themselves, the differences between horses and pigs. In this chapter we shall deal with the modes of acquiring knowledge, which will at the same time show us more fully the various ways in which imperfect knowledge may be supplemented and made more suitable for application.

The three kinds of knowledge

Using the word 'knowledge' in its broadest sense we may distinguish three kinds of knowledge.

1. Acquaintance or knowledge gained through personal experience.
2. Information or knowledge gained from others.
3. Educated knowledge gained through personal investigation.

Acquaintance

We shall begin with the first of these. Personal

experience gives us direct acquaintance with our friends and relations, with the plants, houses and villages in our neighbourhood. We also have direct acquaintance with our actions such as those of eating, walking and writing. When we say we know how to do these things, it is this kind of knowledge that we mean. It is also by this means that we become aware of our feelings and emotions. Acquaintance derived from personal experience has certain characteristics which distinguishes it from other forms of knowledge. The first of these is the fact that this kind of knowledge comes with a certain 'vividness or force', which gives a sense of reality that no other kind of knowledge can give. Thus the song we hear is known to be something real because of its 'impressional force'. The picture we see is for the same reason real though it is a copy of some other reality. When reality breaks into our life, our apprehension is itself characterized by the manner of its entrance, and such manner is inadequately represented by the phrase 'a certain vividness or force'. The flower in the vase and the aeroplane in the distance enter our life in a characteristic manner, enabling us to identify them as real. The second characteristic of acquaintance is a certain intimacy. Thus hearing a song gives us an intimate knowledge of it. Through experience we become identified with the song. While hearing the song we and the song are one. When we enjoy a beautiful sunset we enter completely into the experience. As every one knows, when suffering from toothache we get an intimate experience which no amount of description can give. The third characteristic of acquaintance is that the knowledge it gives is chiefly of wholes. The house

we see before us is almost immediately seen as a whole. The song is heard not as a succession of separate notes but as a song. In this form of knowledge any observation of details is subsidiary to the seeing of wholes.

Experience gives us a living and intimate knowledge of wholes, but its range is very narrow. Seeing an aeroplane can only give us a superficial knowledge of it. The song heard but not examined leaves us with little knowledge of it. Life is not long enough for us to get all the experiences we need nor is it possible for us to travel all over the world. If our knowledge depends only on personal experience, we shall not be able to rise very much above the level of savages.

Information

The second kind of knowledge is information gained through communication. It is by this means that we come to know about other lands, about the history of the world and about the discoveries of others. The first characteristic of this kind of knowledge is its immense range. The information that has already been collected and enshrined in language is so wide that no single individual can ever hope to master it. The second characteristic is that, although the whole is beyond the reach of any one, yet large portions are easily assimilated. By this means many educated people of the present day possess stores of knowledge far wider in extent than the greatest of the ancients possessed. To counterbalance this valuable quality there are less desirable characteristics. Information is second-hand and lacks the intimacy that attaches to first-hand experience.

An object described remains external and is not an intimately known object like one seen. Further, information must necessarily consist of details corresponding to the words used and these must afterwards become constituted into wholes. It also arouses feeling or emotion in a lesser degree than lived experience. For instance, hearing about an accident would move us less than if we saw it. The special danger is that it tends to be memorized rather than assimilated. It is apt to remain a foreign body rather than become a part of ourselves.

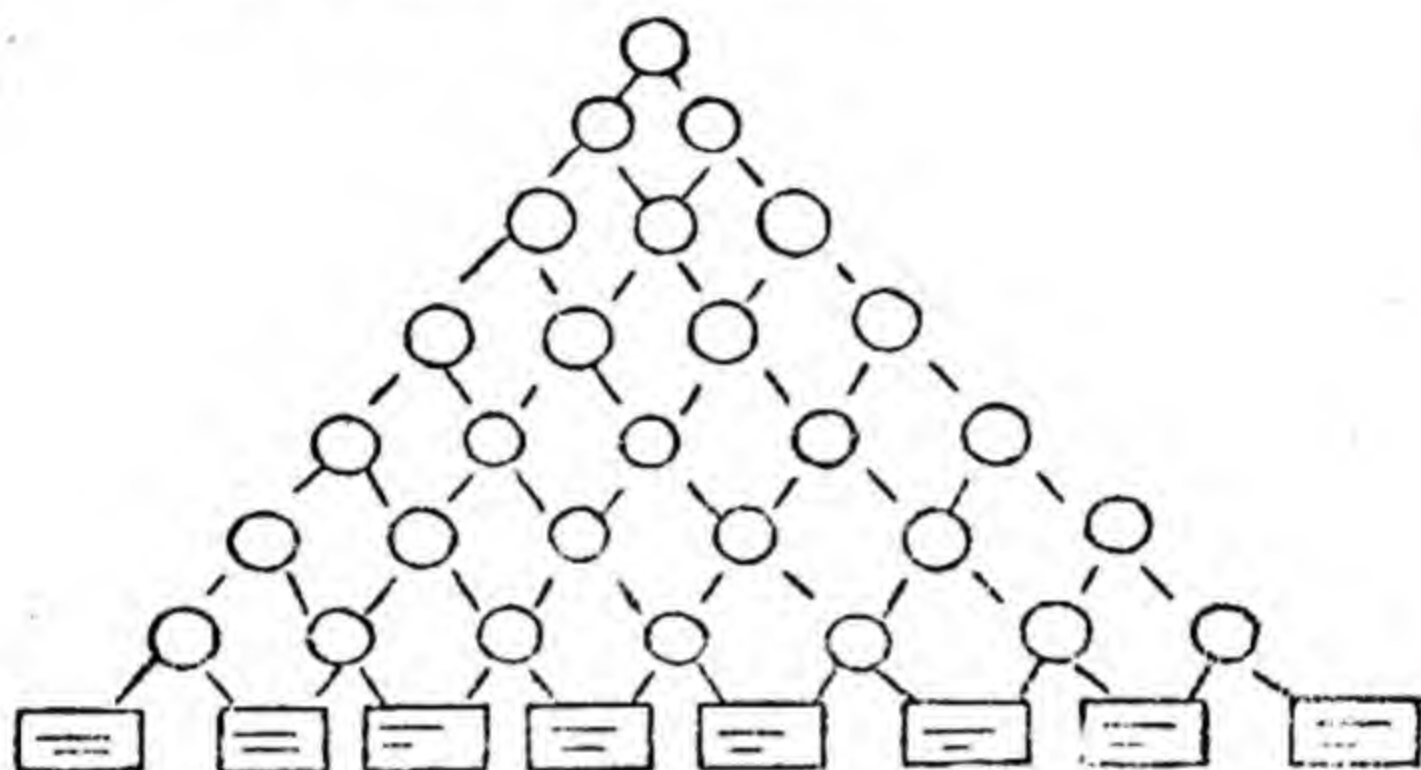
These tendencies, however, show misuse of communicated knowledge. Its proper function is to become fused with personal experience in such a way as to enrich the latter. By such fusion communicated knowledge takes on some of the essential qualities of experience, and experience itself becomes widened. Thus a person who has some information about an aeroplane sees more in an aeroplane than one who does not possess that information. But information about an aeroplane, if gathered for its own sake and if it does not enter into intimate fusion with experience, is mere pedantry.

Educed knowledge

The third kind of knowledge is educed knowledge. By this is meant personal knowledge not immediately arising from experience. It is knowledge resulting from investigation. Experience allows us to see a flower and enjoy it, but investigation enables us to educe from the data detailed and systematic knowledge of the flower, and it is in this way we gain scientific knowledge. By the

examination of a song we can educe its structure. By thinking over the contents of a book we can educe organized knowledge. The first characteristic of educated knowledge is that it is systematic as compared with the patchy knowledge that experience gives us.

The systematic nature of educated knowledge may be diagrammatically shown as follows:



In this diagram the data are represented by rectangles and the educated knowledge by circles.

The second characteristic of educated knowledge is its abstract nature. As will be seen from the diagram the higher the knowledge the greater will be its distance from real experience. The more comprehensive the scientific law, the greater will be its degree of abstractness. A third characteristic of educated knowledge is that it is least associated with emotion. The higher laws and principles of science are essentially colourless, being bereft of emotion. A fourth characteristic of this kind of knowledge is its personal nature. It is therefore, a

possession of the self, intimately its own, not a foreign body.

The relation of educed knowledge to information is that it constitutes one of its chief sources. The discoveries of one generation become the information of the next generation.

The relation of educed knowledge to experience is of fundamental importance. Its function is to systematize the knowledge given by experience and communication. It has also, as we shall see later, a great part to play in facilitating application. The age of science is also the age of invention.

The learner attains full knowledge only when he can fuse, into one, all three kinds of knowledge, any one of which by itself is incomplete.

Corresponding to these three kinds of knowledge there are three modes of acquiring knowledge, namely, (a) through experience, (b) through accepting communications, and (c) through investigation.

We shall examine each of these briefly.

Acquiring knowledge through experience

Acquiring knowledge through experience is the oldest method of acquiring knowledge. Its first characteristic is that the learner's attitude is passive rather than active. When the wise parent surrounds the daily life of his child with beautiful pictures, lets him hear good music, see good behaviour and reads to him noble poems and stories, it is this mode of acquiring knowledge that he adopts. All the learner has to do is to allow these things to affect him. He is not required to study them. As

there are pairs of words corresponding to the passive and active attitudes of the principal senses—for the eye, seeing and looking ; for the ear, hearing and listening—so in this mode of acquiring knowledge the pupil has to see and hear rather than to look and listen. A picture may be enjoyed by the method of seeing as well as by the method of looking. In the former the learner lets himself see the picture, in the latter he takes up an active attitude to the picture. It is the same in music. One may hear it or one may examine it.

A second characteristic of acquiring knowledge through experience is that it is subconscious rather than conscious. In subconscious knowledge we are aware of items as related. Thus on seeing a coloured triangle we have knowledge of a coloured triangle. We see colour and triangularity as related—not that they are related. We see a picture and all the items in it appear as related, although the relations between these are not manifest or explicitly known. Again in listening to a tune we hear the tune as a whole—that is, we hear the notes as related. We do not become explicitly or consciously aware of the relations that exist between the notes. In subconsciously acquiring knowledge it is the relations of which we are subconsciously aware ; the items themselves may be explicitly or consciously known. By this mode we acquire the ‘as’ kind of knowledge not the ‘that’ kind of knowledge which is usually the result of investigation. When this method is used for language learning (as it has been used by Harold Palmer in the form known as Subconscious Assimilation) which consists of short talks, the learner is

not at all conscious of all the grammar, etc., involved in what he hears. He is not required to give an account of what he hears. Were he required to do so, his learning would have to become conscious and involve quite a different mode of acquiring knowledge.

A further characteristic of this mode of acquiring knowledge is that it is the mode by which we become aware of emotional responses. The piece of music we listen to is not only known but is also enjoyed more or less subconsciously. The picture we see produces an emotion in us which also we apprehend. It is because this is the only mode of acquiring knowledge that gives rise to awareness of emotions that its place cannot be taken by any other method in the appreciation of literature, music, art and conduct. This mode is basal to appreciation; other modes can only supplement it and have to be used with care so as not to destroy enjoyment without which there is no appreciation.

Acquiring knowledge through accepting communications

The second mode of acquiring knowledge is through accepting communications, written or oral, of others. Such knowledge, as we have already seen, is called information. This is a very economical method of acquiring knowledge since it makes it unnecessary for the learner to go through the experiences which the original discoverers had to go through. For example, it is now possible to know a good deal about Africa without becoming an explorer. Again, it is possible to learn much about electricity without going through all the experiences that men like Marconi have had to go through. It is consequently

a means of quickly acquiring knowledge. It is, however, not a mode of generating knowledge. It involves only acceptance of knowledge generated by others.

The chief conditions of acceptance are: (a) congruence with past experience, and (b) prestige.

The conditions of congruence have been clearly put by a Director of Education of Ceylon in the following words: 'Past experience, at any given moment, consists of several systems that are more or less consistent within themselves and with one another. These are the stored-up beliefs of our experience. If a stranger enters the mind, he is immediately challenged by one of these mental guards. If the stranger has no friends who can speak for him, no one to claim relationship with him, he is promptly expelled, but with a friend or relation he is welcomed and from henceforth joins the stored up forces of belief in our minds.'

What system of experience is uppermost in our minds at a given moment depends on circumstances. A clever speaker can rouse up in our minds ideas congruent to his argument. If our minds have been stirred up by the revival of memories of poverty, we may accept all that a speaker may say about socialism. After going home, however, we may realize the importance of private property and then give up our belief in socialism. Again, we are inclined to believe all the evil said of our enemies because we have uppermost in our minds the memories of the evil deeds they have done to us. We are similarly inclined to accept the views of the school of psychology to which we ourselves belong.

We are similarly not inclined to believe the things that do not agree with our past experience. We are

reluctant to believe ill of our friends. We do not accept statements that altogether contradict our past experience. We do not admit the views of the political party to which we are opposed.

In addition to these more or less organized systems the mind has more general habits, the most important of which is deference to the authority or prestige of others. We accept the statements of our teachers because we respect them. We put our trust in sacred books, because we venerate them. In general the printed word carries authority with it and we are inclined to believe whatever is in books. The origin of this tendency to yield to suggestion may be due, according to Spearman, to the fact that a child's guardians are continually telling him that something is present and then showing it to him, or promising to do something and then doing it. In this manner the child acquires a general tendency to believe statements made to him by those whom he respects, provided these statements do not too sharply contradict his past experience.

Acquiring knowledge through investigation

The third mode of acquiring knowledge is through investigation. To understand this mode it will be best to compare it with the mode of acquiring knowledge through experience. In the former the attitude of the learner is active; he is searching for something; while in the latter the learner's attitude is passive; he is not searching for anything. He lets experience take its course. He sees the picture rather than examines its construction. He allows himself to hear the melody

rather than try to make out how it is constructed. In investigation the course of experience is controlled. The picture is examined rather than seen. The melody is not so much heard as scrutinized. How to act is found out by trial rather than by imitation.

Not only is investigation active but it is also conscious. The learner knows what he is looking for and knows when he has found it. He can more or less explain what he is looking for and what he has found. In conscious learning of language he looks out for nouns, verbs, idioms, etc. In learning through experience these things do not occupy the focus of his attention.

Another very important difference between these two modes of acquiring knowledge is in regard to the degree in which the emotions accompany knowledge. Scientific investigation aims at getting knowledge uncoloured by emotion. The exclusion of emotion enlarges the scope of abstract knowledge at the expense of concreteness as we have already seen.

A further important difference between the two modes is that investigation is a search for detail with a view to systematization while experience aims at grasping immediately given wholes. The examination of a flower gives us systematic knowledge of the details of its structure, but experience enables us to enjoy it as a whole.

Summary

Knowledge begins in experience and is enriched by communication. It is further developed and systematized by personal investigation.

At each stage there is a different kind of knowledge. At the first stage knowledge is intimate and marked by 'impressional force'. It is also composed of unanalysed wholes. At the second stage knowledge exists as information until it is fused with the first kind of knowledge. At the third stage knowledge exists in systematic form but is abstract and colourless until it is fused with the other two kinds of knowledge. At each stage there is a distinct mode of acquiring knowledge. At the first stage the learner's attitude is passive, his mental processes are subconscious rather than conscious and his experience is real and intimate. At the second stage there is no generation of knowledge but an acceptance of the communications of others in so far as they agree with past experience or are invested with prestige. At the last stage the learner goes in search of knowledge and systematizes the details he discovers.

Just as complete knowledge includes all three kinds of knowledge, namely, acquaintance, information and educed knowledge, so successful acquisition of knowledge requires all three modes, namely, (a) acquiring knowledge through experience, (b) acquiring knowledge through communication, (c) and acquiring knowledge through investigation.

QUESTIONS AND EXERCISES

Enumeration

1. What are the three kinds of knowledge?
2. Name two characteristics of acquaintance.
3. Give two examples of information.
4. Name two characteristics of information.
5. Name two qualities of knowledge gained through investigation.

Completion

1. The relation of educed knowledge to information is that it constitutes one of the chief . . . of the latter.
2. The mode of acquiring knowledge through experience is basal to . . .
3. In investigation the attitude of the learner is . . .
4. In investigation the course of experience is . . .
5. Knowledge begins in . . . ; . . . is enriched by . . . and developed and systematized by . . .

Right or wrong?

1. Information is gained through personal experience.
2. In investigation we see things as wholes.
3. Information has a very narrow range.
4. Lived experiences are marked by 'impressional force'.
5. Educated knowledge is abstract.
6. Our past experiences make up one consistent whole.
7. In accepting information there is no generation of knowledge.
8. Complete knowledge involves all three kinds of knowledge.

ADDITIONAL QUESTIONS AND EXERCISES

1. Give five examples showing the distinction between knowing about a value and feeling a value.
2. Name ten things that you have found out for yourself during the last ten days.
3. Give five examples of generalizations you have accepted on mere authority.
4. Give five examples of generalizations you have worked out for yourself.
5. 'We may appropriate the products of the mental activity of others.' Comment on this statement.
6. Give a brief account of how we acquire knowledge.
7. Is it possible to distinguish between information and knowledge?

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8. How would you teach a child to understand the meaning of weight?
9. To develop appreciation of pictures would you show children pictures? Or tell them about pictures? Or question them about the pictures shown?
10. To make children kind to animals which of the following methods is best?
 - (a) Reading poems about animals.
 - (b) Making pupils memorize such poems.
 - (c) Keeping pets at school which the class may feed and care for.

CHAPTER IV

THE PHASES AND STEPS OF TEACHING.

RESERVING for later chapters the detailed analysis of fixation and application, we shall in this chapter first examine the teaching phases that correspond to the phases of learning, then the steps of teaching that arise from their use and finally compare them with the Herbartian steps.

Phases

Since teaching consists of directing and helping learning, the phases of teaching will correspond to the phases of learning, which are the acquisition, fixation and application of knowledge. Helping the pupil to acquire knowledge should be the first phase of teaching; the next, helping the pupil to fix his knowledge so that he may easily reproduce it; and the last, helping the pupil to apply his knowledge in a real way so as to further the ultimate aims of education.

These are not necessary phases like the phases of learning. The teacher may or may not go through all these phases, but it is his duty as one who directs learning to see that the learner does go through all the phases of learning. To make sure that the pupil does go through each phase the teacher has frequently to use tests. These will be described later.

The fact that the teacher's help is not necessary at each phase of learning but only at the phase where the

pupil is weak, has caused negligent teachers to disregard their duty. Such teachers offer no help at all at any phase of learning but content themselves with setting work and testing. This is the unsatisfactory type of teaching called 'lesson-hearing'. An opposite error is made by another class of teachers who offer more help than necessary at one phase, especially the phase of acquiring knowledge, and then take no further steps to ensure that the pupil does go through the fixation and application phases. This is the error to which teachers who adopt the lecture method of teaching are most liable.

To ensure complete learning the teacher must see to it that the pupil not only acquires knowledge and fixes it so as to be able to reproduce it but is also able to apply it to real life. As we have said before, few teachers regard the last as a part of their duty. Many teachers feel that they have done their duty if they make sure that the pupil can reproduce knowledge gained. It is because reproduced knowledge does not necessarily lead to real application, that the teacher must consider it an important part of his duty to see that the pupil does apply knowledge to real situations when he is still at school.

The first phase

The function of the first phase is to help the pupil to acquire knowledge. To do this the teacher has three fundamental devices, namely, showing, telling and asking thought-provoking questions. In actual practice however, no fundamental device is ordinarily used by

itself. Usually all the devices are used together but one is emphasized and stands out as the dominant device. This practice gives rise to modes, which are distinguished from each other not by the devices used in them but by the dominance given to one of them. The chief modes are the demonstration mode, the lecture mode and the discussion mode. Reserving their detailed discussion to later chapters, we may now briefly illustrate these modes.

Suppose we wish to teach the appreciation of a picture and we decide to adopt the demonstration mode, we shall concentrate on showing the picture in the best possible manner with a suitable setting and suitable lighting. We may also say something about the picture and ask some questions, but if these devices are given greater emphasis than showing, the pupil's attitude will change and the special advantage of the mode of acquiring knowledge through experience will be lost.

Instead of using the demonstration mode we may decide to use the lecture mode. In this case telling becomes our principal device. We shall describe the picture and explain its meaning and the pupil will accept the information. Showing and questioning in this mode will be subordinate to telling.

Instead of using either of these modes we may decide to use the discussion mode. In this case our principal device will be the thought-provoking question. With the picture before the class we shall ask questions enabling the pupils to look for the chief points in it. We shall also give some information, remembering, however, that it is characteristic of this

mode that it should enable the pupil to find out as much as possible himself.

The second phase

The function of the second phase of teaching is to help the pupil to fix his knowledge so that he may reproduce it easily when required. The devices at the disposal of the teacher are repetition and organization by the education of relations. By means of the former he can make sure of the exact reproduction of disconnected items, while by means of the latter, he can ensure the correct reproduction of what the pupil has understood. If the teacher emphasizes repetition he uses the Drill Mode, while if he emphasizes organization he uses the Review Mode. These modes will be explained in detail later but their importance may be realized from the following. Most teachers realize that the facts of the multiplication table, for instance, cannot be fixed only by the repetition that occurs in application exercises. Separate drill also, apart from application, has been found to be essential. In the teaching of history and geography, though drill in fundamental facts is more essential than many teachers recognize nowadays, the fixing of historical and geographical knowledge will be quite unsatisfactory unless the teacher employs the Review Mode, enabling the pupil to organize his knowledge.

The third phase

The function of the third phase of teaching is to help the pupil to apply his knowledge. He may do this by

means of either formal or real exercises. The chief formal exercises are either substitute exercises, such as verbal problems instead of real problems, partial exercises such as practice in speech sounds instead of in sentences, which are the natural units of speech, and miniature exercises in which complete activities are practised but on a reduced scale. When the teacher gives prominence to formal exercises he uses the Formal Application Mode. When he emphasizes real exercises he uses the Real Application Mode. The full discussion of these modes must be reserved for later chapters but an important point may be mentioned here. Formal exercises are much more helpful for the teaching of habitual abilities than for the teaching of constructive abilities. Formal exercises in speech, number and piano-playing are universally recognized to be necessary; but invention, creation and discovery cannot be taught piecemeal or by substitute exercises. Such abilities cannot be gained without doing real exercises.

The steps of teaching

From the point of view of steps, teaching falls into the same sort of types as learning. There will be one-step teaching, two-step teaching and three-step teaching. We shall proceed to explain and illustrate them.

One-step teaching is the kind of teaching which accompanies one-step learning. Learning to walk is an example of one-step learning since the acquiring, fixing and applying of knowledge take place more or less

simultaneously. As an example from the classroom we might take the following: Suppose the aim is to develop the ability to read maps. Large maps of China and Germany are placed before the class and each boy has his own atlas before him. The lesson consists of learning to 'read' the maps. The work begins with application since the pupils have to apply their past knowledge to begin 'reading' at all. The teacher asks questions, helping the pupils to find more than they knew before in the maps. He asks so many questions that a fair amount of fixation takes place, and throughout he has helped the process of application, as the pupils were continuously engaged in 'reading'.

The following is an example observed by the writer of the one-step teaching of history. The aim of the lesson was to enable the pupils to give a connected oral account of the 'Thirty Years War'. No information was given without being immediately questioned upon, and throughout the lesson individual children got up and gave oral accounts of various sections of it. In this lesson the application consisted in giving a connected oral account. Acquisition of knowledge and fixation were made by the teacher to go closely with the application.

An example from arithmetic is the following: The exercise was 'Reduce 364217 seconds to days'. The pupils began to work, as they had already learnt how to reduce minutes to days. The teacher went round the class, helping the backward pupils both by telling and questioning.

It will be seen from these examples that one-step teaching begins with an application and that it is the

appropriate type of teaching when we wish to begin a lesson with an exercise. This will happen in cases where we consider action more important than knowledge.

In two-step teaching the application is distinct from the acquisition of knowledge. Thus a lesson on percentage may be given as follows: 'The teacher first explains what percentage is and works on the board a typical sum. This is the step of acquisition of knowledge. This is followed by a number of oral and written exercises, enabling the pupil to fix and apply his knowledge.

Two-step teaching is the natural type to use in the inductive type of lesson. Suppose the teacher's aim is to make the pupil learn the rule that the verb-ending '-ed' in English as in 'picked' is pronounced under certain conditions as 't' not 'd'. He will present to the pupil several examples such as 'ticked', 'licked', 'pushed', 'rushed', 'tapped', 'lapped', and by questions help him to educe the rule that '-ed' after unvoiced consonants except 't' is pronounced as 't'. By the time the rule is educed it will also have been fixed. The next step will be to set a number of oral exercises consisting of sentences in which words of this type are used.

Two-step teaching is also the usual mode of teaching intelligent appreciation of music. By means of suitable questions the teacher helps the pupil to find out and fix in his mind the beauties of the piece listened to. Then the pupil is required to work an exercise which consists in finding beauties in a similar piece.

In general it will be found that two-step teaching is appropriate when a lesson begins with the acquisition of

knowledge but in which there are not many items of knowledge which can be consciously fixed. Generalizations and appreciations will usually be taught in this way.

Three-step teaching is the kind of teaching in which the teacher attends separately to each phase of learning. This will be necessary either with small children for whom learning will be easy if the phases are kept distinct or with older children in lessons of the information type in which many facts require fixing. We shall illustrate these two cases.

In the case of a child learning multiplication, it is necessary first to help him to build up a table, then to help him to fix it in his mind by repetition, and lastly to give him practice in using the multiplication facts. Similarly in teaching him how to hold a pen, it will be helpful first to demonstrate to him how to hold it lightly with the pen resting on the second finger and with the first finger well in advance of the thumb, then to ask him to demonstrate how to hold it in the correct manner, and finally to give him practice in writing.

As an example of an information type of lesson in which there are many facts to be fixed, we may take one from geography. A description of the Rhine Valley may be read from a book which is explained and supplemented by the teacher. Then will follow rapid-fire questions to make sure that the pupils know the facts. There will be further questions of the thought-provoking type to help the pupils to organize their knowledge. The lesson will end with suitable exercises, requiring the application of knowledge. The normal form of a history lesson in the upper classes will be similar to the above. The teacher

will amplify in narrative form or by questions those parts of the lesson on which he wishes to lay emphasis. Then will follow rapid-fire questions and review questions to ensure suitable fixation. The last step will be the working of exercises.

Herbartian steps

The theory of steps outlined above, which depends on the recognition of the three phases of learning, namely, acquisition, fixation and application of knowledge, may be compared with the steps suggested by the German philosopher Herbart (1776-1841) and developed by his followers. These steps at one time exerted a great influence in the teaching world and many trained teachers attempted to cast all their lessons into the Herbartian form.

In the developed form there were five steps in the method, which were :

1. Preparation.
2. Presentation.
3. Comparison.
4. Generalization.
5. Application.

Suppose the aim of the lesson was to teach the rule, already mentioned, regarding the pronunciation of the verb ending '-ed'. At the step of preparation the aim would be stated, and with the help of questions the pupils would be made to realize the need for some rule. At the step of presentation examples like 'picked', 'tapped', 'rubbed', 'charged' would be presented. At the next step these would be compared and divided into two classes,

those with an unvoiced sound before '-ed' and those with a voiced sound before '-ed'. At the next step generalizations would be suggested by pupils and the correct generalization chosen, and if the last step was correctly interpreted by the teacher, practice in the use of the generalization would be given.

If this example illustrates the Herbartian Method correctly, then it corresponds to our two-step type of teaching, as the first four Herbartian steps are concerned with the acquisition of knowledge and incidentally with its fixation, and the last step with application. There is, however, in the Herbartian steps no clear realization of the necessary phases of learning. The first four steps represent an analysis of induction, not of learning. In passing we may say that the steps of the Problem and Project Methods also do not represent the phases of learning. They represent steps involved in doing the two kinds of exercises.

If we regard the Herbartian Method as a form of two-step teaching we see at once its limitations. It will not be suitable for the lessons, especially skill lessons, for which the one-step type of teaching is most suitable. It will also not fit the information type of lesson which requires a separate step of fixing. In actual practice these limitations were discovered by practising teachers and the unfortunate result was the banishing of the Herbartian steps altogether from schools. Rather than do this it is better to recognize the limitations of the Herbartian Method and to use it for its legitimate purpose, as a two-step method, for the teaching of generalizations.

Summary

The phases of teaching correspond to the phases of learning. At each phase the teacher uses one or more of the devices at his disposal, namely: showing, telling, questioning and setting exercises. As a rule one of these devices is dominant. A method of teaching in which one device is dominant may be called a mode. The relation between phases, modes and devices may be diagrammatically represented as follows:

<i>Phases</i>	TEACHING	
	<i>Modes</i>	<i>Devices</i>
1. Helping acquisition of knowledge.	(i) Demonstration. (ii) Talk or Lecture. (iii) Discussion.	(i) Showing. (ii) Telling. (iii) Questioning.
2. Helping fixation.	(i) Drill. (ii) Review.	(i) Fact questions. (ii) Organizing questions.
3. Helping application.	(i) Formal application. (ii) Real application.	(i) Formal exercises (ii) Real exercises.

From the point of view of steps there are three types of teaching, viz.: one-step, two-step and three-step teaching. In one-step teaching, the acquiring, fixing and application take place more or less together. This type of teaching may be used whenever action is considered more important than knowledge. Two-step teaching is suitable for the teaching of generalizations and of appreciation. Three-step teaching in which the three phases of learning are separately attended to is necessary for lessons of the information type and is helpful for reducing the difficulties of all learning.

The Herbartian Method is best regarded as a form of two-step teaching specially useful for the teaching of generalizations.

QUESTIONS AND EXERCISES

Enumeration

1. Name the phases of teaching.
2. Name the devices that the teacher may use during the first phase.
3. Classify teaching with reference to steps.
4. What is the chief defect of lesson-hearing teachers?
5. What do lecturing teachers tend to neglect?

Completion

1. It is the teacher's duty to see that the pupil goes through all the . . . of . . .
2. Reproduced knowledge does not . . . lead to application.
3. In each mode one device is . . .
4. In the Discussion Mode the dominant device is . . .
5. The methods of fixing knowledge are . . . and . . .
6. The Herbartian steps are useful for learning . . .
7. Teaching is essentially . . . and . . . learning.

Right or wrong?

1. The phases of teaching are necessary phases like the phases of learning.
2. To teach is to explain.
3. There is no difference between drill and review.
4. The Herbartian steps are only concerned with the first step of learning.
5. The Herbartian Method is a two-step method of teaching.
6. Formal applications are useless.
7. Phases of teaching must be based on an analysis of learning.
8. The phases of teaching are the same as the modes of acquiring knowledge.
9. Fact questions are useful for helping the pupil to acquire knowledge.

ADDITIONAL QUESTIONS AND EXERCISES

1. Discuss the question of steps in teaching.
2. Why is the Herbartian Method not suitable for the teaching of all subjects?
3. In what ways are phases different from steps?
4. From the point of view of steps what is the commonest type of teaching?
5. Can a lesson begin with application?
6. Explain why good teaching must conform to the way the pupil naturally learns.
7. Explain the statement that pupils may learn in spite of the school rather than because of it.

CHAPTER V

THE DEVICES OF SHOWING, TELLING AND QUESTIONING

IN this chapter we shall examine the fundamental devices at the disposal of the teacher for helping the pupil to acquire knowledge. They are showing, telling and questioning. It is these that the teacher employs with varying emphasis in actual modes of teaching, such as the lecture and the discussion. The devices, though not much used by themselves, are here dealt with in isolation in the belief that the more complex modes will be better understood if the elements are first examined.

Showing

Showing is in this book used to mean any method of helping the pupil to undergo and apprehend experiences.

The chief experiences that a pupil needs may be classified as (a) sensory experiences, and (b) emotional experiences.

Sensory experiences are obtained through the medium of the sense organs. The most important of them are visual, auditory and kinæsthetic experiences. The last, which are experiences of movement, are specially important in the acquisition of skills.

To arouse visual experiences we have many devices at our disposal. We may show real objects in their natural

setting by taking pupils on excursions. This device has become well-established in the teaching of geography as it has been realized that words like 'mountain' and 'river' have no reality unless at least one example of them has been actually seen. It should also be used in history teaching because a child needs to see such things as ancient buildings, factories and courts of justice before his conceptions of them can become real. Another device for arousing visual experiences is the showing of specimens. 'These are little bits of reality removed from their natural setting.' Examples are seeds, grains, leaves, flowers, plants, woods, soils, rocks, minerals, metals, animals and manufactured articles. They are essential in the teaching of science and geography. A detailed lesson on a flower should not be given without a flower for each child to examine nor should there be a first lesson on cotton cultivation in which a cotton plant is not shown. A third device for arousing visual experiences is the showing of models. 'These are not real objects but three dimensional representations of them. They include such things as globes, relief maps, models of engines and dynamos, and models of the eye and the ear. Models of large things lack the details that the real objects have but are more easily handled. They also bring out clearly the principal outlines. Therefore they are essential in the teaching of complex realities. The globe, for instance, is essential to the successful teaching of geography. Models of small objects help us to see details more clearly. After models come pictures. These are two dimensional copies of reality. They are essential in all cases where first-hand acquaintance with reality is not

possible. Pictures of other countries give a reality to geography teaching that no amount of verbal description can give. Approximation to reality can be made by the use of motion pictures but these only the richer schools can afford to have. Projection of pictures with the aid of a lantern or epidiascope is better than passing pictures round the class, and is a device within the reach of most schools as these instruments are now comparatively cheap. The last device for arousing visual experiences is the use of maps, charts and diagrams. These are not copies of real things but aim at showing the outlines of real objects. Their value lies also in this fact. A map gives an idea of a whole which no amount of visiting a country can give. A chart shows weather conditions as a whole which no individual observation can give, and a diagram of the nervous system gives an idea of it as a whole which no amount of dissection can give. Before concluding this section a word must be said about the use of the blackboard. Good teachers make extensive use of the blackboard because they have found it of immense help in the successful use of the device of showing.

The term 'show' is used in a wider sense when it is used to cover presentation for arousing auditory experiences. The value of this kind of experience is obvious in the teaching of language and music. Speech must be heard and cannot be learnt off a book of grammar alone nor can the appreciation of music be learnt by reading books on theory. Auditory presentation has been greatly facilitated in these days by the use of the radio and the gramophone.

When we show pupils how to do things, two sets of

experiences are necessary. When a pupil is shown how to write, he should not only see how the teacher writes but he must also become subconsciously aware of his own movements, as he can never learn to write only by observing someone else's movements. In this case the visual experiences help him to correct his kinæsthetic experiences. In the case of speech and singing the correcting experiences are naturally auditory experiences, not visual experiences.

Emotional experiences are aroused by appropriate showing. To enjoy drama, literature, art and music, these must be shown in the best possible manner and in the best possible setting. Teachers of literature often do not realize that the commonest cause of failure of appreciation is bad reading by the teacher.

The manner of showing must satisfy the conditions appropriate to each sensory mode. The distance, the position of the object together with the amount of light available have to be considered. The blackboard must be so placed that it is easily visible to all and does not shine. Sounds must be distinct and clear as well as loud enough and when the teacher speaks he should observe the same conditions. When actions are shown, the speed must be reduced to suit inexperienced pupils. Special seating arrangements should be made for those who are shortsighted or are hard of hearing.

Summarizing this section we may say that the usual object of showing is to produce visual, auditory, kinæsthetic and emotional experiences. The technique of showing is based on the necessity for showing in the best possible manner.

Telling

The second device for helping the pupil to acquire knowledge is telling, which leads to acceptance of communications.

Telling falls into various classes. Single objects are described. Things in space are described and events in time are narrated. A flower may be described by mentioning its colour, shape and fragrance and by detailing its parts. An account of a war may be given by mentioning the chief battle and where they took place. Successful description and narration require that the detail should be neither too little nor too much. If the details are too few, there is not enough material to build up a whole. If the details are too many, the wood cannot be seen for the trees.

As an example of over-elaboration of detail we give the following extract from *The Mabinogion*:

‘And the youth pricked forth upon a steed with head dappled grey, of four winters old, firm of limb, with shell-formed hoofs, having a bridle of linked gold on his head, and upon him a saddle of costly gold. And in the youth’s hand were two spears of silver, sharp, well-tempered, headed with steel, three ells in length, of an edge to wound the wind, and cause blood to flow, and swifter than the fall of the dewdrops from the blade of reed grass upon the earth when the dew of June is at the heaviest. A gold hilted sword was upon his thigh, the blade of which was of gold, bearing a cross of inlaid gold of the hue of the lightning of heaven; his war-horn was of ivory.’¹

¹ J. A. Green and C. Birchenough: *A Primer of Teaching Practice*, p. 30 (Longmans).

As an example of a good narration we quote the following from Charles Reade's *The Cloister and the Hearth*.

'The bear was mounting the tree on the other side. He heard her claws scrape, and saw her bulge on both sides of the massive tree. Her eyes not being very quick, she reached the fork and passed it mounting the main stem. Gerard drew breath more freely. The bear either heard him or found by scent she was wrong. She paused; presently she caught sight of him. She eyed him steadily, then quietly descended to the fork.

'Slowly and cautiously she stretched out a paw and tried the bough. It was a stiff oak branch, sound as iron. Instinct taught the creature this: it crawled carefully out on the bough, growling savagely as it came.

'Gerard looked wildly down. He was forty feet from the ground. Death moving slow but sure on him in a still more horrible form. His hair bristled. The sweat poured from him. He sat helpless, fascinated, tongue-tied.

'As the fearful monster crawled growling towards him, incongruous thoughts coursed through his mind. Margaret—the Vulgate, where it speaks of the rage of a she-bear robbed of her whelps—Rome—Eternity—

'The bear crawled on. And now the stupor of death fell on the doomed man; he saw the open jaws and blood-shot eyes coming but in a mist.

'As in a mist, he heard a twang, he glanced down; Denys, white and silent as death, was shooting up at the bear.'

Descriptions and narrations must be: (a) clear, (b) orderly, (c) interesting.

To be successful at this kind of work the teacher must have a clear idea of what he is going to narrate or describe; he must then form a plan so as to make his account orderly, and he must choose words and phrases that are interesting.

Among the other ways of telling are giving definitions, causes, reasons and meanings. The simplest kind of definition consists in mentioning the use of a thing. Thus a chair is something to sit on, a knife is something to cut with, horses are for riding. Logical definition consists in setting forth the attributes essential to the notion defined. Thus a coin is a piece of metal made into money by official stamp; coke is the solid substance left when volatile parts have been distilled from coal; and a segment is a part cut off or separable or marked off as though separable from the other parts of something. This kind of definition is, of course, the last stage in the progress of knowledge and must not be used at its beginning.

Giving causes is one of the commonest methods of explaining. As in the case of defining, the less systematized our knowledge the more elementary is the cause that can be given. A person looks paler than usual. We say he is ill because we have found that paleness and illness usually go together. An electric light is burning. The immediate explanation is because the switch has been put on. Similarly a plant dies because it has not been watered. Wood warps on account of heat. The gradation of causes according to the degree of knowledge we possess may be seen from the following series of causes, explaining the fall of a book.

1. Because it is heavy.
2. Because all bodies fall unless prevented from so doing.
3. Because of the earth's attraction.
4. Because all bodies attract each other with a force directly proportioned to their masses, and inversely as the squares of the distance.

The deeper cause cannot be explained to the pupil until his systematization of knowledge has reached a high degree.¹

In giving reasons, the next mode of explanation, we use not the relation of cause but the relation of evidence. Thus:

All men are mortal.

John is a man.

Therefore John is mortal.

As a rule, however, all the parts of an argument are not mentioned. Thus: 'Charles is not listening because his eyes are turned away.' 'A person at a lecture who is looking at his watch is bored.' 'If you can hear a pin drop in a school, then there is good discipline there.' In these examples only one premise is mentioned.

The last method is by giving meanings or equivalents. Thus to elevate is 'to raise or lift.' 'To smother' is 'to stifle', a 'rustic' is a 'countryman', 'supplication' is 'prayer', 'iniquity' is 'wickedness', an 'anecdote' is a 'tale', 'inanimate' is 'lifeless', and 'eccentric' is 'peculiar'.

It will be seen that all these methods refer to systems of knowledge already existing in the minds of the pupils. The teacher's knowledge is more systematized than the pupils'. Herein lies the cardinal difficulty of all

¹. Green and Birchenough, *op. cit.*

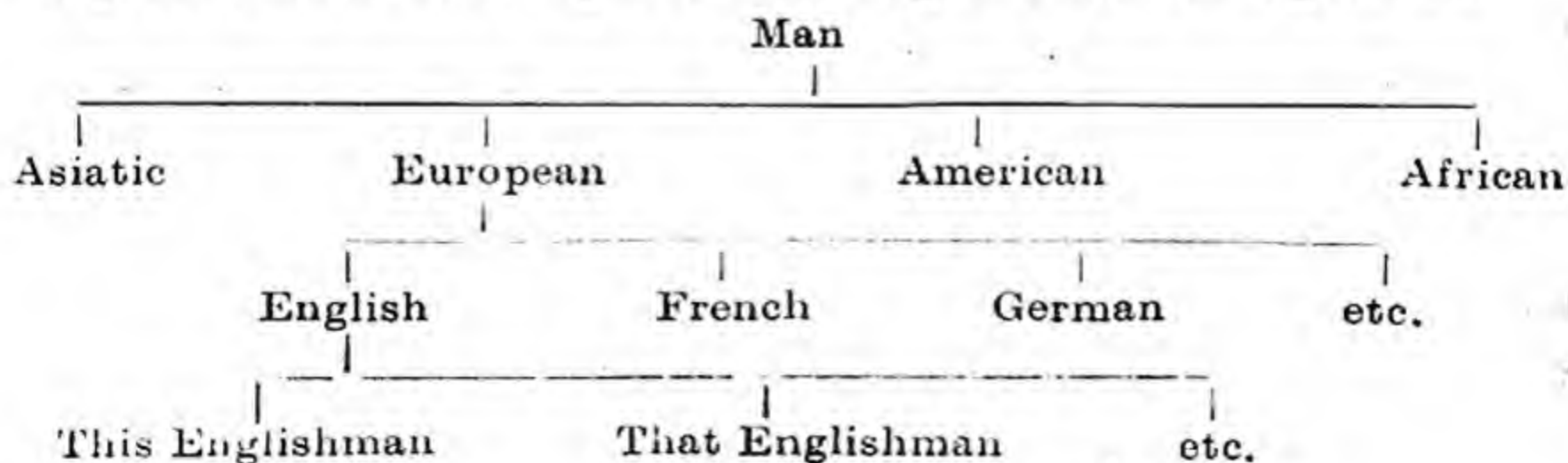
modes of explaining. An explanation which is valid to the teacher may be not at all clear to the pupil, because he is unable to interpret it with his past experience.

Illustration

It often happens that a matter put before the pupil may be understood by him but not with sufficient clearness. On such occasions the teacher employs the device known as Illustration. Objects may be made clear not only by telling but also by showing and questioning, but the subject of illustration is dealt with here because of its close connexion with telling.

The commonest form of illustration is the example. When a general idea, rule, method or law is not clear, examples may be given. If the idea of a noun is not clear additional examples may be given, such as: John, tree, dog. In arithmetic if the idea of percentage is not clear, we give examples. In language, if the direct method is not understood clearly we may give a lesson employing this method. If the law of gravitation is not understood, we give examples.

The relation of the examples to what is illustrated is the relation of particular to general. This relation may be understood by considering the following table.



In all cases the examples refer to something more general. At the bottom of the table are real examples or pictures of them.

Another way of making ideas clear is by analogy, that is, by comparing them to something real. The relative sizes of the moon and the sun may be compared to those of a pea and a football.

Similes are often used to clarify meanings. Thus 'The desert lay like a sea before us'. 'Sweeping gusts of rain came down before this storm, like showers of steel.' 'He disposed of courts, and crowns, and camps, and churches, and cabinets, as if they were the pieces on a chess-board.' 'Like a huge bird, the aeroplane descended.'

'The quality of mercy is not strained.

It droppeth as the gentle rain from heaven

Upon the place beneath.'

'I have ventured like little wanton boys

That swim on bladders, this many summers

In a sea of glory; but far beyond my depth.'

Related to the simile are the parable and the allegory which are also comparisons. Analogy goes beyond telling when the thing to which comparison can be made is something that can be known by experience. At this point telling gives place to showing but the latter is used in subordination to the former. Graphical representation is an excellent method of making abstract ideas clear.

The relative position of English shipping may be made clear by a series of lines proportional to the tonnage of each country. Maps, charts and diagrams are well-known methods of making knowledge clearer.

Illustration makes use either of the relation of identity or of the relation of similarity. It is important to remember that illustrations have no value in themselves. They are successful only in so far as they illustrate. Hence illustrations must not draw too much attention to themselves. As real objects and pictures are in themselves interesting, they have to be used with care.

The primary methods of telling are describing, narrating, defining, giving causes, reasons and meanings. When ideas explained are not sufficiently clear, they may be clarified with the help of examples, analogies, similes and graphical representation.

The question

The question is the general device for making the pupil educe or reproduce knowledge and can be used whenever these operations are required from him.

At the first phase of teaching the function of the question is to help the pupil to educe relations (and correlates); in other words, to think. Examples of such questions, which are usually called thought questions are as following:

Which do you consider the three most important inventions of the nineteenth century?

Was the execution of Charles I justified?

Compare Eliot and Thackeray in ability at character delineation.

Why is the House of Commons a more powerful body than the House of Lords?

At the second phase of teaching the function of the question is to cause the pupil to reproduce facts. These are often called fact questions.

Examples of fact questions are :

When did William the Conqueror invade England ?

On the blank map provided, insert and name :
Belfast, Cork, Dundee, Edinburgh, Hull.

Name three British possessions in Africa.

At the third phase of teaching there will be thought questions for helping pupils to make plans of action. Thus by asking questions pupils may be made to find out how best to repair a chair or to see that one style of writing a letter of thanks is better than another style.

Questions may also be used for testing—a subject which will be dealt with later.

The kind of answers pupils are required to give also affords an important basis for classifying questions. When long answers are expected, the pupil may be asked to describe, to narrate, to explain or to illustrate. In the written form these are called essay type questions. The following are examples :

Describe street traders that you have seen.

Give an account of a festival you have seen.

Explain with reference to its context :—

‘ Love’s not love

When it is mingled with regards that stand
Aloof from the entire point.’

In contrast with these are the new type questions which require short answers. As illustrations we give the following :

Similarities test

Here are two columns of phrases. In the second column there is one phrase which means a great quantity

or degree of something suggested by a phrase in the first column. For example, (4) means faster movement than (g).

- | | |
|----------------------------------|------------------------------|
| (a) Minor ailment. | (1) Much ado about nothing. |
| (b) Passing fancy. | (2) First rate. |
| (c) Scarcely polite. | (3) Absorbing attachment. |
| (d) A little fuss over a trifle. | (4) With lightning speed. |
| (e) Fairly well. | (5) Whole-hearted merriment. |
| (f) A laugh or two. | (6) Serious illness. |
| (g) At a moderate pace. | (7) Thorough gentleman. |
| (h) Chance acquaintance. | (8) Windy oration. |
| (i) Milk and water criticism. | (9) Lifelong comrade. |

Find phrases which make a similar pair with (a) (b) (c), etc., and write the pairs in your answer book, one pair on a line in this way :

(g) and (4)

Best reason test

Some places which are a long way from the equator are hotter in summer than places near the equator because: (a) the days are longer, (b) the sky is not so cloudy, (c) the longer days enable the sun to warm the ground for longer periods.

Which of these reasons is correct ?

Association test

Connect the words in column D with appropriate words in columns A, B and C.

A	B	C	D
Asia	mountain	rice growing	Manitoba
Europe	valley	wheat growing	Calgary
North America	plain	sugar growing	Canterbury Plain
South America	river	maize growing	Geneva
Australia	plateau	tea growing	Winnipeg
Africa	lake	coffee growing	Smyrna
	town	fruit growing	Karachi
	sea port	cotton growing	Dimbulla
	air port	cotton manufacture	Buffalo
	lake port	sheep rearing	Doldrums
	cape	pig rearing	La Plate
	strait	fruit market	Mackenzie
	sea	dairy produce	Chicago
	pass	fishing	Superior
		coal mining	Valparaiso
		iron smelting	Florida
		ship building	Covent Garden
		cattle rearing	Bristol
		salt making	Hawaii
		leather making	Natal
			Ruhr
			Yokohama
			Liverpool

Arrangement test

Choose six of the following eight events and arrange them in historical order, beginning with the most recent.

The Battle of Trafalgar.

Captain Cook sailed to New Zealand.

Jack Cade's Rebellion.

The English victory at Crecy.

'Remove that bauble', ordered Cromwell.

The first train ran between Liverpool and Manchester.

The Death of Becket.

Richard I led the third Crusade.

Completion test

Instructions. Fill in the blanks so as to make sense.

'I am by nature extremely susceptible to street affronts: the——— and taunts of the populace; the low bred triumph they——— over the casual trip, or splashed——— of a gentleman: Yet can I——— the jocularly of a young sweep with——— more than forgiveness. In the——— winter but one, pacing along Cheapside with my accustomed——— when I——— westward, a treacherous slide brought me upon my back in an instant. I scrambled up with——— and shame enough, yet outwardly trying to face it down, as if——— had happened, when one of the roguish——— of these young wits encountered me.'

There are a number of points that the teacher should bear in mind in regard to the technique of questioning. He should have clearly in mind whether the question he asks is a thought question or a fact question. If it is a thought question he should allow sufficient time for thinking but he may ask fact questions in rapid-fire order. Ordinarily no special order should be observed in the distribution of questions, but the teacher will find it helpful to have a list of pupils by him so as to ensure that all pupils are asked questions, say, within the week. Adoption of a special order may induce those who have been asked questions not to attend to the remaining questions. It is best not to name a pupil before asking questions so as

to ensure that all do some thinking. Questions once stated should not be repeated unless they are particularly difficult. The teacher should be able to ask questions without constantly looking at the textbook. He should also be on his guard against forming the mannerism of 'echoing' answers, that is, unnecessarily repeating them. While taking care not to answer irrelevant questions, he should encourage pupils to ask questions. He should not be afraid to admit his lack of knowledge when he is asked a question which he cannot answer. Types of questions he should not use are 'yes' and 'no' questions not followed by thought questions, ambiguous and badly worded questions, and questions that suggest their own answers.

This section may be summed up as follows:—Questions either put the pupil into an investigating attitude or cause him to reproduce previously acquired knowledge. The essay type question requires a long answer while the new type question requires a short answer. Either type may be used for educating or reproducing knowledge. The technique suitable for each type is different, but in both types the teacher should guard against forming mannerisms such as 'echoing' answers.

QUESTIONS AND EXERCISES

Enumeration

1. Classify sensory experiences.
2. Classify devices for arousing visual experiences.
3. What are the chief ways of arousing auditory experiences?
4. Name some of the chief points in the technique of showing.
5. Classify the varieties of telling.
6. What is the chief difference between explaining and illustrating?

7. Classify questions.
8. Name the chief points in the technique of questioning.

Completion

1. We show real objects in their natural setting by taking pupils on . . .
2. Models bring out clearly the principal . . .
3. Description should be . . . and interesting.
4. The commonest form of illustration is the . . .
5. Illustration makes use either of the relation of . . . or of the relation of . . .
6. 'When did William the Conqueror invade England?' is a . . . question.

Right or wrong?

1. Questions are only useful for testing.
2. Questions should be asked rapidly.
3. A pupil should be named before a question is asked.
4. Specimens are real objects removed from their setting.
5. Models are two dimensional copies of reality.
6. Diagrammatic representation is a kind of illustration.

ADDITIONAL QUESTIONS AND EXERCISES

1. Is it unwise to address a series of successive questions to a single student? Justify your answer.
2. Give illustrations to show that the following have made lessons clear :—diagrams, pictures, models.
3. Give two instances of poor use of the blackboard.
4. Why does the question hold the important place that it does as a teaching device in our schools?
5. How can the teacher help to make knowledge real?
6. What is the chief function of questioning?
7. Give examples of leading questions. Why should a teacher avoid questions of this class?

8. Write the questions which you would ask a class who had read a description of a river, in order to stimulate their thought.
9. How many questions do you ask during one hour's work? Observe some other teacher, and count the number of questions he asks.
10. Why is it important to consider the form of the wording of the question you ask?
11. How can you challenge the attention of every member of your class by the question which you ask?
12. Why is it poor method to repeat the answer given by one of the pupils?
13. Do your pupils recite to you, or to the class?
14. When would you expect children to ask questions? To whom should such questions be addressed?

CHAPTER VI

THE DEMONSTRATION MODE

THE Demonstration Mode is that mode of teaching in which the device of showing is dominant. It is essential for the teaching of appreciation, habits and skills and sense-knowledge. A picture must be shown before it can be enjoyed; a good habit must be seen before it can be copied; skill at good handwriting cannot be acquired without seeing good writing and without the experience of writing, and the material objects of the world cannot be perceived without sensory experiences.

There are three varieties of the Demonstration Mode. They are: (a) The simple demonstration, (b) the explained demonstration, and (c) the discussed demonstration.

In all these the dominant process is demonstration. In the first, showing is used alone. In the second, it is helped by telling, and in the third, it is helped by questioning. These will remain varieties of demonstration only if telling and questioning are kept subordinate to showing. We shall briefly describe each of the varieties.

The simple demonstration

This mode, in which no assistance whatever is given to the pupil beyond showing as a whole, must be closely adjusted to his attainments. A poem that may be presented without explanation to a post-primary class, may have to be explained in detail to a primary class.

A skilled worker may be shown how to do a new thing without explanation but the same action may have to be described in detail to an unskilled man. An advanced class in nature study do not need a description of a flower, but beginners do.

As a mode of helping the pupil to acquire knowledge consciously this variety of the Demonstration Mode has little value, as it is difficult to acquire new abilities consciously without the help of explanation or discussion. For instance, as soon as we set out to learn a new poem consciously, we begin to ask questions. When we desire to learn consciously a new action, we tend to ask at once how to do it. Similarly if we consciously aim at acquiring knowledge of the structure of a flower, we tend to assume at once an inquiring attitude.

On the other hand as a means of helping subconscious learning this variety of demonstration has great scope. It is well known that habits of conduct and fashions are for the most part caught subconsciously. In these it is the example that matters. An example here means something demonstrated or shown. Appreciations may also be caught. A poem may be appreciated simply because the teacher appreciates it. A certain familiarity with objects may also be acquired in this subconscious manner. A child brought up in an artistic environment subconsciously becomes familiar with artistic objects. The same sort of thing will happen to a child in a musical environment. Good breeding is also largely caught in this manner.

Systematic use of this mode for subconscious learning of school subjects has been attempted, so far as the writer

knows, only in the teaching of language and literature. Harold Palmer, the well-known language teacher, makes great use of this mode, which he calls Subconscious or Free Assimilation. It consists in speaking to the pupil in the foreign language for the purpose of enabling him to become gradually familiar with it. The essence of the method is that the learning remains subconscious. The pupil is not asked to do anything consciously. He has merely to allow himself to hear the language.

Story telling, not followed by questions, is a well known method used by kindergarten teachers for making pupils familiar with stories suitable to their age. Simple poems are also used in the same way by these teachers. There is no reason why teachers of higher classes should not make use of subconscious learning. If they do so, they should remember to control the desire to explain and question which have no place in subconscious learning.

To facilitate subconscious learning by this variety of demonstration all that the teacher can do is to make a suitable selection of objects for presentation and to present them in a good setting. Of course the ordinary conditions of sense experience must be satisfied. Objects must be easily visible and sounds must be easily heard.

The explained demonstration

In this variety of demonstration any of the varieties of telling—namely, describing, narrating, defining, etc.—may be used with demonstration. But they have to be kept subordinate to demonstration; otherwise the mode

will change from demonstration to lecture. Such shifting from one mode to another deprives the lesson of all unity. Before teaching begins, the teacher should make up his mind as to the mode he desires to employ. For instance, if he has to teach appreciation, he should decide on using some variety of the Demonstration Mode. When he uses explanation to help his demonstration he should remember that the mode is still the Demonstration Mode. Within the mode any variety may be used but the mode itself should not be changed.

We may illustrate this variety of the Demonstration Mode from the teaching of literature, remembering that showing with reference to literature means reading aloud by the teacher or by pupils, or silent reading by the pupils. Poetry and drama have usually to be read aloud while novels are as a rule read silently.

W. C. Ruediger in his *Teaching Procedures*¹ gives the following account of a teacher's procedure in teaching Shakespeare. 'The first thing to do in the teaching of Shakespeare is to give the children a full description of London; of the manner of dress, of living, of work, of amusement of the people. A description of the theatre, the lives of the theatre-folk, the audience and of the way plays came to be written should come next. The pupils are fascinated by it. Then should come a narrative of Shakespeare's life, in which the human side of the man is brought out. Pupils have the queerest conceptions of him. Anecdotes about him and his contemporaries—red-headed Ben Jonson for example—should be given. Two or three days are valuably used in this way.'

¹ p. 150 (Harrap, 1932).

In studying *Ivanhoe* several periods may be spent in learning about Crusades, Orders of Knights, tournaments, the life of Richard the Lion-Hearted and medieval instruments of torture.

It is a debatable point whether the explanation should include an outline of the story or play. One objection is that the charm of the selection is destroyed if the pupil is not allowed to discover for himself the plot, etc. Thus to tell pupils in advance that James Fitz-James in *The Lady of the Lake* is King James is to destroy a good part of the enjoyment. It may be concluded that what the pupil can discover for himself should not be told to him. Only where the language is difficult, as in Shakespeare's plays, should the plot be outlined briefly to enable the pupils to follow more easily.

The description of the setting should be followed by the presenting of the entire selection. To deal with it part by part is to suggest to the pupil that the selection is difficult, thus discounting enjoyment. Besides, a selection has an essential unity which the pupil must grasp, since it is the relations within the unity which yield a large part of the enjoyment. A second reading during which the teacher explains in greater detail should follow.

After a suitable introduction a poem should be read by the teacher in the best manner possible. It may also be read by pupils who can read well. Bad readers should not be asked to read aloud as appreciation cannot be secured through bad reading. The appreciation lesson should not be turned into an elocution lesson which is a skill lesson. A second reading with suitable comments from the teacher should follow.

After the setting has been explained, Shakespeare's plays should be read by the teacher in the most dramatic way possible. The good readers of the class may also be allowed to take the parts of the various players. The reading in any case should be such as to ensure enjoyment. This should be followed by a second and detailed reading for the removal of difficulties.

The reading of a long novel, which should be preceded by an introduction, has to be largely done outside school hours. A daily assignment should be fixed by a 'right or wrong test' to ensure reading. The test must be general enough for a single reading. A detailed reading with comments from the teacher should follow the first rapid reading. The object of this is the appreciation of details.

The explained Demonstration Mode may also be illustrated from the teaching of skills.

The unit of work in teaching a skill may be either a formal exercise or a real exercise. Formal exercises are generally derived by analysing complex skills into simpler skills. An example is the alphabetic method in teaching reading. The pupil practises reading letters, then words of one syllable, next words of two syllables, and so on. A similar analysis may be made for the teaching of speech. Thus Palmer divides speech into the following simpler skills:

1. Observing sounds, etc.
2. Imitating them.
3. Repeating them.
4. Associating them with meanings.

5. Composing language material on the analogy of words and forms already memorized.

Addition may be regarded as consisting of the following series of skills:

1. Combinations up to 20
2. Two line sums not involving carrying, e.g. 10
5
—
3. Tens in both cases not involving carrying, e.g. 12
14
—
4. Numbers under 100, e.g. 20
28
—
5. Three figures in each line, e.g. 402
575
—

6. Carrying.

The traditional or academic method of teaching skills is by means of formal exercises. The modern method is to select as units real exercises and to use formal exercises in close conjunction with them. The sentence method in reading is generally considered to be a method that uses real exercises. It should be remembered, however, that the sentence method will only become real if it is combined with some real situation. Suppose the situation chosen is that connected with starting for school. Then the unit of work will consist of such sentences as: 'I must get ready.' 'I must get my books together.' 'I must start at 8 o'clock.' In addition to these the beginner will need some formal

exercises on such matters as speech sounds before he can say the sentences correctly.

The use of real exercises is now common in the teaching of drawing. The pupil is allowed to begin by drawing real objects, the method being demonstrated and explained to him by the teacher. In arithmetic also real exercises may be used by utilizing the situations that arise during the carrying out of projects.

There is experimental evidence to show that the modern method of combining real and formal exercises is better than the traditional or academic method of proceeding from the logically simple to the complex. Real exercises must also be simple to start with. As far as analysis is concerned the difference is one of degree. Those who support the academic method begin with the simplest elements while those who support the modern method stop analysis at meaningful and real wholes.

The explained demonstration mode is suitable for use either with real or formal exercises. The unit must be demonstrated as a whole and its details explained. The explanation consists chiefly in making the pupil see the different steps of the action. The succession of acts involved in a skill may be seen by considering the following instances. A spoken sentence is a succession of syllables or words. The act of handwriting may be subdivided into such acts as sitting down properly, holding the pen correctly, holding the book correctly, beginning at the right point, etc. The act of summarizing may be divided into: (a) reading through to get the main thought, (b) closing the book and writing down the

main thought, (c) reading to note the thought in each sentence and deciding which points should be incorporated in the summary, (d) revising critically what has been written. All these should be both demonstrated and explained by the teacher.

Everything presented to the learner which fits in with previous experience will be understood by him in terms of that experience. This may facilitate or hinder his learning. For example, in so far as the sounds, phrases, etc. of one's own language correspond with those of a foreign language, the learning of that language will be facilitated. Where they do not correspond but are similar, the speech-habits of the mother-tongue will intrude and hinder the acquisition of the new language. Hence an exploratory test should, when necessary, precede explanation so that the teacher may know what explanations to give.

In the case of motor skills when the act presented is not one the pupil is already familiar with, he has to attend to two sets of sensory experiences. For example, in pronouncing sounds he has to attend to feelings of movement from the speech organs and to control them by means of auditory experiences from the sounds pronounced by the teacher, produced by a gramophone or remembered by himself. In handwriting the feelings of movement from the hand have to be controlled by the visual experiences arising from the model or those remembered by himself. The model may be learnt by tracing letters on sand but the control cannot be learnt by tracing since writing is not tracing. To learn writing one must write perhaps with one guide line at first and

with none at all finally. In general it may be said that in teaching a new motor skill two things have to be explained to the pupil, (a) the standard and its qualities, and (b) the movement itself.

As the qualities of the standard as a whole may not be present in the parts, it is important that in putting together the parts, steps should be taken to secure the qualities of the whole. Thus the sentence 'The pig is in the net' may at first be mastered word by word but very soon it should be pronounced with proper rhythm, stress and intonation.

In making a chair, the pupil must have a clear idea not only of the parts but of the whole chair and the result required. Gardening is not merely a series of diggings but producing a plot of a definite standard.

In the same way in the case of mental skills the pupil must attend not only to the steps of the process but also to the qualities of the standard. In addition to knowing the steps of summarizing, for example, he must know the good qualities of a summary such as compactness, brevity, clearness and unity.

The movement is learnt by imitation but the standard has to be learnt by observation. When the explained demonstration mode is used, it is the duty of the teacher to supply instances such as good models in handwriting, model sounds and sentences in speech-training supplied by himself or with the aid of a gramophone, samples of good summarizing, samples of chairs in handwork, good garden plots, etc. The pupil must not be allowed to fall into bad methods by blind trial-and-error learning for lack of good models or standards.

Accuracy and speed are the two essentials of skill. At first, however, accuracy must be aimed at rather than speed. Emphasis on speed must wait until form has been mastered sufficiently, that is, until the stage of reproduction is reached. Attention to correct form and technique may be discouraging as far as immediate results are concerned, and the pupil, especially if he is an adult, may be impatient, but there is no doubt of its importance. As S. S. Colvin says:¹

‘It is particularly essential in the beginning of all school activities that the teacher see to it that the pupil’s attention is upon that part of the learning which is essential for the correct formation of the habit to be desired.’

It should be mentioned here, to prevent misunderstanding, that skills may be taught not only by the Demonstration Mode but also by the Discussion Mode. When the latter mode is used, the action is not demonstrated and explained, but the pupil is allowed to make an attempt in his own way. The attempt is then discussed until a satisfactory method is found. Thus in beginning drawing, when the Discussion Mode is used, the pupil will begin by drawing things in his own way and then find by discussion the best way.

The discussed demonstration

We have now reached the third variety of demonstration. It has an unfamiliar name but it is, as a matter of fact, extensively used. In it discussion accompanies demonstration but is kept subordinate to the latter so as to ensure that demonstration has the right

¹ *The Learning Process*, p. 65 (Macmillan, 1920).

degree of emphasis. It may be used as a supplement to the explained demonstration but it may also be used independently, provided it is remembered that discussion always assumes the possession of a reasonable degree of knowledge and ability.

To illustrate this variety of the demonstration mode we shall give an account of how a teacher taught his class, which was unfamiliar with European music, appreciation of Dvorak's *Humoresque*. He began the lesson by playing a gramophone record of the piece. He then asked the pupils whether they thought the piece contained a number of tunes. There was general agreement that it consisted of a succession of tunes. After the pupils had been told to count the number of tunes, the record was again played. There was little agreement as to how to find out when a tune ended. Various suggestions were made such as that there is a distinct break at the end of each tune, that the last note is longer than the others, that there is a sudden difference of pitch, and so on. When the piece was played a third time there was much greater agreement as to the number of tunes. Some pupils spontaneously remarked that many of the tunes were repeated. It was then decided to put the record on again to decide how many different tunes there were in it. It was found out that there were only three different tunes. A discussion arose as to the arrangement of the tunes and it was agreed that they were arranged in the order A B A C A B. When the piece was about to be put on again for the last time, the bell rang, but the pupils wanted the lesson to continue. After the last rendering of the piece the teacher inquired whether the

piece was now enjoyed much more than before. All but one of the pupils were strongly of opinion that their enjoyment was now vastly greater than at the beginning.

In the opinion of some writers the discussed demonstration is essential to the successful teaching of literature. M. J. Stormzand in *Progressive Methods of Teaching*¹ says: 'If pupils cannot be led to make discoveries for themselves, the chance of their enjoying such elements is slight. This may often strike the teacher as æsthetic blindness, but it may safely be assumed to be the blindness of immaturity. There is too much danger of overloading a child's capacity for appreciation by subtleties and sublimities, elusive charm and cleverness. This well-meaning attempt to serve all one's bounty will create either mental indigestion or a suspicion that the teacher's enthusiasms are not genuine. What the pupil himself does not actually see, he will put down as affectation; insistence will be stamped as pretence, and the more fervently it is put, the more hypocritical will it be judged.'

In teaching the appreciation of art, too, the discussed demonstration may be used. Suppose it is Burne-Jones's 'Golden Stairs' that is being studied. With the picture before them the pupils should by discussion find out 'the many repetitions of sweet maidenhood, of the flesh-colours, of the bright flowers, and of the actions of descending', and 'at the same time' they should find out 'how all this is preserved from weariness by the fact that every figure presents in every respect its own distinct

¹ Houghton Mifflin Company, 1924.

individuality.' They should also observe how all this makes a harmonious whole.¹

In the teaching of skills also this variety of the Demonstration Mode may be used. Both the model and the action may be discussed. In the teaching of handwriting, the pupils may, by discussion, find out the qualities of good writing such as uniformity of slant, alignment and proper spacing between letters, words and sentences. The action may also be discussed and such matters as how to hold the pen and the book, and where to begin writing may be discovered.

In the teaching of nature study the discussed demonstration is generally preferred to the explained demonstration.

In general it may be said that Discussed Demonstration is much slower than Explained Demonstration. On the other hand the former method gives a degree of confidence, clarity and fixity of knowledge that the latter method does not.

Summary

The dominant device in the Demonstration Mode is showing. Its chief varieties are the simple demonstration, the explained demonstration and the discussed demonstration. The first variety is best adapted for subconscious learning. It is the usual way in which we learn from the environment. Conscious use of it in the school is recent but is already more or less established in the teaching of language and literature. The second variety,

¹ Adapted from C. Spearman's *Creative Mind*, p. 48 (Nisbet and Cambridge, 1920).

explained demonstration, is well-established and is much used in the teaching of skill and appreciation. The third variety, the discussed demonstration, is extensively used though not often recognized as such. It is more time-consuming than the second variety but it has counter-balancing advantages. It is essential that the teacher should remember that the explained demonstration and the discussed demonstration are varieties of demonstration—in other words, that when these varieties are used, telling and questioning must be subsidiary to showing.

QUESTIONS AND EXERCISES

Enumeration

1. Name three types of demonstration.
2. Give two reasons in favour of a setting in the teaching of literature.
3. Name the chief ways of showing.
4. Name the subjects that may be taught by the Demonstration Mode.
5. What is the dominant device in the explained demonstration?
6. What is the dominant device in the discussed demonstration?

Completion

1. . . . experiences are very important in teaching skills.
2. The unit of work in teaching a skill may be a
. . . . exercise or a exercise.
3. Habits of conduct and fashions are for the most part
caught ■ ■
4. There is no appreciation without
5. A daily assignment should be fixed by a test for
in
6. A reading should follow the first reading.
7. Analysis into the simplest elements is required by the
. . . . method.

8. . . . and speed are the two essentials of a skill.

Right or wrong?

1. The 'form' of movement in a skill should be made prominent in the first stages of learning.
2. Experiment has shown that kinæsthesia plays a prominent part in the acquisition of skill.
3. Much emphasis should be put in the early stages on the technical side of literature.
4. Every member of the class should get a chance of reading aloud a poem studied.
5. The 'setting' should be followed by detailed study.
6. The modern method is better than the academic method.
7. Past experience always facilitates learning.
8. A whole action has qualities that are not present in its parts.
9. In the acquisition of skills, speed should be emphasized from the very start.

ADDITIONAL QUESTIONS AND EXERCISES

1. Why should the teacher show, either by model or personal demonstration, what the skill or habit is that is to be learned and the method of doing it?
2. What advantages does the discussed Demonstration Mode possess?
3. What is explained demonstration? To which subjects is it applicable?
4. Outline the technique for the appreciation type of lesson.
5. How are higher tastes in music, literature and art developed?
6. Give examples of learning situations in which the pupils would be seriously handicapped by defective sense organs.
7. Prepare a lesson plan for teaching music by means of gramophone.

CHAPTER VII

THE LECTURE MODE

THE second mode of helping the pupil to acquire knowledge is the Lecture Mode. We shall first of all distinguish between the talk and the formal lecture and then consider the chief varieties of this mode. As textbooks are closely connected with our topic we shall devote a final section to that subject.

The talk and the formal lecture

The word 'lecture' in the phrase 'lecture mode' is used to cover communications of all degrees of complexity from the chance remark to the formal lecture. Without attempting to draw any sharp line of division we may divide communications according to their degree of complexity into talks and lectures. Talks are simple and lectures are complex. The talk is the proper type to use in the primary school. The beginnings of the lecture appear only in the post-primary school. Its systematic use has to await the university stage. The formal lecture is unsuitable for young children because they are not capable of much prolonged attention; because it is difficult to adjust it to children's attainments and needs and there is danger of telling much that is not understood by them; because where lecturing is the only method used nobody works hard except the teacher; and because it tends to give the lecturer a false idea of his ability as a teacher. These objections, of

course, do not apply in the same degree to the formal lecture when it is used with advanced pupils.

The correct procedure in lecturing is as follows:

1. The outline.
2. The filling in of details.
3. The summary.

In the outline the chief divisions of the subject are mentioned. This prepares the listener for a broad view of the whole subject so that he may see the relationship of the parts to the whole. At the second step each of the main points is dealt with in detail to enable the listener to understand the facts. At the third stage the whole subject is summarized briefly, making it possible for the listener to realize the vital significance of the main points. It is necessary to distinguish carefully between the outline and the summary. The outline is like a diagram or skeleton but the summary is like a very small-sized picture of some real thing. The outline is the scaffolding but the summary is the real structure, only on a reduced scale.

Much has been written on the technique of lecturing. The first point to remember is that lectures require careful planning, and that at first, at any rate, it is best to use written notes. It is also necessary to face the audience and to look at the audience in order to find out from their physical reactions and facial expressions how the lecture is being received. The voice, too, has to be carefully managed. Every member of the audience ought to be able to hear the lecturer but the voice must not be lifeless, monotonous, unnecessarily loud or too high-pitched. Words must be well chosen and uttered

distinctly and with proper emphasis. Of course attention to grammar and style is essential. Outlines and summaries should be put on the blackboard.

Very often teachers are afraid of using either the talk or the formal lecture and attempt to do all their teaching with the help of the question device only. They should realize that a great many things have to be told. The political divisions of a country, for example, cannot be discovered by pupils nor the relative values of the chief imports and exports of a country. The geographical conditions that make a great city, however, can be educed by suitable discussion. The facts of history cannot be elicited by questions, though principles can. The judicious use of telling is to be strongly recommended but the talkative teacher should be on his guard against mistaking interest in the teacher for comprehension of the subject. The teacher who uses the Lecture Mode simply because he loves to talk has mistaken his vocation.

Müller in his *Teaching in Secondary Schools*¹ sums up the value of the Lecture Mode in the following words: 'The introduction to any subject—and this includes the industrial and fine arts—requires a considerable amount of telling; the content subjects, foreign languages, mathematics, and sciences call for skilful telling all along; so that the importance of developing a worthy technique in the use of this method is not only evident for those who are going to teach junior and senior pupils but is imperative.'

¹ Appleton, Century.

Varieties of the Lecture Mode

The varieties of the Lecture Mode are: (a) The simple talk or lecture. (b) The demonstrated or illustrated talk or lecture. (c) The discussed talk or lecture.

The first variety is the simple talk or lecture unaccompanied by either demonstration or discussion. In the second variety the talk or lecture is helped out by demonstration while in the last variety the talk or lecture is interspersed with discussions originated by teacher or pupil.

We shall briefly describe each of these.

The simple talk or lecture

As a method of more or less subconscious acquiring of information this method is in everyday use. From what others say we pick up a good deal of information relating to all kinds of things. Acceptance in such cases is generally uncritical. In a similar way we accept ideas from newspapers and incidental reading. Many adults use only this method after leaving school.

Conscious use of the talk is well recognized in the primary school, where teachers are accustomed to give little talks on historical, geographical and scientific topics. Its judicious use is recommended in all primary classes. To talk successfully it is necessary that the teacher should have a thorough knowledge of what he talks about. With the development of broadcasting it has now become possible to make experts available for supplementing the efforts of teachers. Talks on world history are given over the radio by outstanding experts who provide the wide but accurate sweep over the vast

field of material that historians alone can give. In geography, travellers give accounts of countries they have actually visited. In science, research specialists point out the bearing of their work on the facts of everyday life.

What should be expected from informal talks and lectures is a background rather than systematic knowledge.

The demonstrated or illustrated talk or lecture

This variety differs from the first in that demonstration is used to make the talk or lecture more clear. It is also not the same as the explained demonstration. There the object studied is the object demonstrated. Here the essential object studied is not a sensory object but some group of ideas conveyed by means of language and the sensory objects are only used to make the thoughts clear.

This is the usual variety of the lecture for the purpose of teaching geography and history. A description of China, for instance, must be supported by maps, diagrams and pictures. A first lesson on William the Conqueror requires not only maps but also pictures of warriors of those days. In using this mode the teacher has to take care not to let the illustrations draw too much attention to themselves. An excellent device for preventing this is to put the outline on the board, enabling the teacher to go from point to point without undue delay. The summary too must be put on the board and copied by the pupils.

Maps, charts, diagrams, models, pictures, slides and

specimens lend a realness to the spoken word that cannot be secured in any other way. The same material presented in the form of graphs, or charts, or supplemented by means of pictures, produces an entirely different effect on the learner than if merely told or explained without such visual aids. Similarly a lecture on the theory of music supported by the playing of extracts is much more interesting and helpful than one without such aids.

Whenever the teacher plans to use such aids, it is a good point in technique to have all devices fully prepared and conveniently arranged for use at the proper time. When apparatus or mechanical devices of any sort are to be used, the teacher should test them before the lecture to make sure that they will work satisfactorily.

The discussed talk or lecture

This is the third variety of the Lecture Mode. It is the natural variety to employ with higher classes where pupils already possess a sufficient stock of knowledge. It can, however, be used with lower classes provided discussion is limited to familiar topics. Thus the pupils may discuss such subjects as health with the teacher instead of merely listening to his remarks. As discussion is liable to be side-tracked, it is a good thing for the teacher to put the outline on the board and to see that the discussion is limited to the points at issue. This will also prevent the mode from changing from lecture to discussion. The teacher should not forget that the discussed lecture is a lecture with discussion. The summary should be gradually built up and put on the board as it

develops. The chief advantages of this variety of the mode are permanence of material, greater understanding, a sense of reality and easier recall and reconstruction. These advantages will be further explained and illustrated in the chapter dealing with the Discussion Mode.

Textbooks

Books used in school are of various kinds. Some are chiefly collections of exercises for use with the application modes to be described later. To this class belong books on arithmetic and algebra. Others are books of literature such as Scott's *Marmion* and Dickens's *David Copperfield*. Still others contain information, such as books on geography, history and science. Literary texts contain material to be appreciated and they are best taught, as has already been shown, by the different varieties of the Demonstration Mode. Information books may be used in two ways, either as material to be taught or for reference reading. The first involves the use of the Lecture Mode and the second the Discussion Mode.

Using information books as reference material is quite common after one leaves school. It is not so common in schools but should be more extensively used. In the lower classes references may be given to parallel textbooks, as such books are graded and can be chosen to suit the capacities of pupils. When children's encyclopædias are available they should be used. Standard works of reference may be used with the more advanced classes. The technique of using the table of contents and the index should be known to post-primary children.

On the question of whether information books, such as

those on geography, history and science should be used as the material to be taught, opinion is divided. The advantages of textbooks are the following: They are permanent records of communications which can be consulted as often as one wishes and therefore superior to the lecture which is only heard once. They are compact arrangements of educational material. They generally contain more details than lectures. They make uniform education throughout a country possible. They make it possible for the teacher to make definite assignments for self-study. The limitations of textbooks are the following: They are not usually written by authorities on their subjects. They also lend themselves to a wasteful method of teaching, as we shall see.

The textbook may be treated in various ways. There is one method which is nowadays universally condemned. It is sometimes called the lesson-hearing method and sometimes the textbook-recitation-testing method. It consists of assigning reading, without explanation or discussion, and then devoting practically the whole lesson period to testing. This method has to be condemned because the teacher gives no help to the learner and because it usually involves only reproduction of items memorized. It is the favourite method of the lazy teacher, as it enables him to escape the burden of helping the learner at the first phase of learning, namely, the acquisition of knowledge.

The Lecture Mode, as we have already seen, may be used with textbooks. The combined book and lecture method has earned for itself in France a special name, *lecture expliquée*. It may be called in English the method

of commenting. This is one of the oldest methods of teaching. Sacred books have always been explained in this way. Teaching in the medieval universities usually took the form of comment on old Greek and Roman books. The general procedure in commenting on textbooks should be (a) to give an idea of the outline, (b) to comment in detail on each section of the book and (c) to present the pupil with a summary of the book.

The Discussion Mode may also be used with textbooks, this being the natural mode to use when reference readings are assigned. It is especially useful with advanced classes. When this mode is used, the sections of the book will be clarified by explanations and illustrations given by both teacher and pupils. This is one of the best methods of developing a critical spirit in reading, a frame of mind so needed in these days when thousands of readers are in the habit of thoughtlessly accepting everything that is in print, not only in books but even in newspapers. In the next chapter the Discussion Mode will be explained in greater detail.

Summary

The second mode of instruction is the Lecture Mode. The term includes both informal talks and formal lectures. The former is suitable for young children while the latter is used to advantage only with advanced pupils. The organized lecture consists of an outline, details and a summary. The varieties of the Lecture Mode are (a) simple talks or lectures, (b) demonstrated or illustrated talks or lectures and (c) discussed talks or lectures. In the first variety help is given either by demonstration or

discussion. In the second variety the lecture is made more real with the help of specimens, pictures, diagrams and maps. In the third variety the lecture is better fitted to the needs of the pupil by the discussion he is allowed to take part in. The textbook may be a book of information or may be a literary text. When such books are used as material for teaching it is wrong merely to assign reading and then ask test questions. In textbook teaching the method of commenting should be used with younger children while with older pupils the Discussion Mode in which ample use should be made of reference reading is preferable.

QUESTIONS AND EXERCISES

Enumeration

1. Give four reasons why the textbook has such an important place in education.
2. Name the advantages of textbook teaching.
3. State the difficulties connected with the lecture method for immature pupils.
4. State two modes that may be used with textbooks.
5. Name two ways in which telling is superior to showing.

Completion

1. The textbook writer is usually a . . . authority in the subject.
2. The greatest evil connected with textbook teaching is that the class period is used for . . .
3. One of the most important phases of book study is the getting of a proper . . . at the beginning.
4. Young pupils are too . . . to give prolonged auditory attention.
5. The lecture method often gives the teacher a . . . idea of his . . . in teaching.

6. Telling should be used whenever a very . . . or . . . impression is essential.
7. When the difficulty is due to the complexity of the object presented, the remedy is . . .
8. In teacher-explanation the pupil has the advantages of hearing an . . .
9. Relations may be explained by means of diagrams. This is called . . . , . . .
10. The essential steps in the Lecture Mode are (a) . . . (b) . . . and (c) . . .

Right or wrong?

1. Textbooks should be thought of as complete, exhaustive treatments of a subject.
2. The lesson period should be chiefly used for the purpose of testing a pupil's preparation.
3. Reading should always be careful reading.
4. The lecture method economizes the time of the learner.
5. A good method of removing doubt is comparison.
6. Too much teaching in the sense of explanation is not possible.
7. Statements that sharply contradict past experience are easily believed.
8. Telling gives more certainty and confidence than showing.
9. Comparison includes simile, metaphor and parable.
10. A net is satisfactorily explained by saying that it is a reticulated structure.

ADDITIONAL QUESTIONS AND EXERCISES

1. Is there a danger of giving too many illustrations of a principle?
2. Why is it that a teacher never gets to know his pupil's needs when he lectures all the time?
3. Give examples in which a teacher failed because he did not clothe his ideas in suitable language? . . .

4. Why is the textbook so commonly used in our schools? What are the advantages and disadvantages of this method?
5. The textbook-recitation-testing method is said to be a very wasteful and inefficient method. Why is this so?
6. What are common objections to the Lecture Mode? Which ones are most valid?
7. Discuss the importance of the outline and summary in connexion with the Lecture Mode.
8. How should textbooks be taught?
9. What are the merits of the demonstrated or illustrated lecture?
10. What are the merits of the discussed lecture?
11. If a pupil recites the words of the book, does he know the subject? In what method is the pupil most likely to memorize words?
12. What is the method of commenting?
13. Compare the different varieties of the Lecture Mode.

CHAPTER VIII

THE DISCUSSION MODE

THE third mode of helping the pupil to acquire knowledge is the Discussion Mode. The essential meaning of the word 'discussion' is examination or consideration from various points of view, especially by talking over or by going over the reasons for and against. It also means to talk about or to reason together. In brief, it may be said to be examination helped by talking over. The talking over usually involves two or more persons, but one person alone may discuss a matter by stating the arguments for and against. The Discussion Mode of teaching corresponds to the Investigation Mode of learning. It is a mode specially favourable for developing the ability to invent, create and discover. Problems and projects are the material on which discussions are based. In this chapter we shall distinguish the chief varieties of the Discussion Mode and then treat each of them in detail.

Varieties of the Discussion Mode

Discussion is conducted by question and answer and is therefore the mode in which the question device is dominant. We may distinguish three varieties of this mode.

1. The Simple Discussion.
2. The Demonstrated Discussion.

3. The Explained Discussion.

In all three varieties the teacher's aim is discussion but in the second and third varieties discussion is helped out by showing and telling respectively. To subordinate investigation by using either showing or telling as the dominant device will have the effect of changing the pupil's attitude altogether and he will cease to investigate, but if these two devices are made subsidiary to discussion, the pupil can be greatly helped in his investigation. We shall briefly describe each of the varieties of the Discussion Mode.

The simple discussion

Simple discussion is that variety of the Discussion Mode in which the question is used alone. Of course, telling in the form of legitimate answers to questions is an essential part of the discussion. The term 'legitimate answers' is used advisedly as it is quite possible for a speaker to change an answer into a lengthy speech, thereby changing the mode from discussion to lecture. Lengthy speeches are, of course, out of place in a simple discussion.

From the point of view of form we may distinguish between free and controlled discussions. Free discussions in the form of conversations occur extensively in daily life. Their systematic use is common in the primary school where short conversations often take place in regard to points of conduct or health habits, the children being encouraged to ask questions. Free collective conversations used in any part of the school should ordinarily be brief, as it is difficult to prevent such conversations

from straying into all kinds of irrelevant side-issues. Free individual conversations, however, of considerable length, which are called conferences, are desirable with advanced pupils. Controlled discussion also admits of many forms. One kind is the form in which the teacher controls the discussion. The Herbartian method belongs to this kind. As a simple example of this method we may take the case of a first lesson on adverbs. By asking questions on parts of speech already known the teacher prepares the mind of the pupil for the new topic. Then, also with the help of questions, examples are collected and compared. Hypotheses are next elicited and tested by application until a satisfactory hypothesis is developed. The Herbartian method is an example of a teacher-controlled discussion leading to the discovery of a generalization, but a similar method may be used for the organization of facts. Thus pupils who have studied their textbooks can give the causes and build up a summary of the Industrial Revolution. Similarly a teacher may cause pupils to examine a flower and elicit from them its structure. In this form of controlled discussion the teacher asks questions and decides who should be allowed to answer. He should also encourage pupils to ask questions spontaneously rather than frown on them when they do so. Another variety of controlled discussion is the formal debate in which the number of times a person may speak is fixed by convention. On account of its formal character, this is not a very suitable method for daily use but its occasional use will add variety to the usual work. An important variety of controlled discussion is the socialized discussion in which

the control of the discussion is left to the pupils. Socialized discussion offers pupils opportunities to make plans, to make individual contributions, to challenge, to criticize and to make summaries. Its advantages are: it makes pupils more interested in their work; it develops qualities of leadership and initiative; it makes it easier for diffident pupils to ask questions, as some pupils do not like to ask the teacher questions. It also gives a training in courtesy and consideration. There are, on the other hand, many disadvantages in this method. Pupils are not usually able to direct discussion as a teacher can. Assertive pupils may take all the time. Discussion may stray into side-issues and be wasteful of time. Some of these disadvantages will be reduced if the debate form is adopted. On the whole it may be said that in primary and post-primary schools socialized discussion should be used only occasionally for relieving monotony. However valuable socialized discussion may be for adults, teacher-controlled discussion is most appropriate in schools.

The following points are important in regard to the technique of conducting discussions. The person in control should continually keep in mind the purpose of the discussion and be alive to the danger of desultory remarks. When he realizes the discussion has gone astray, he must bring the class back to the main topic. He should see as far as possible that everybody gets a chance of speaking. He should specially encourage the more backward pupils. He should encourage pupils to ask questions, and seriously asked questions should receive respectful attention. No response should be

ridiculed but the leader should insist on all answers being the best the pupil can give. He should also insist on good expression. Finally, it is his duty to summarize the results of the discussion when he thinks it has lasted long enough.

The demonstrated discussion

The demonstrated discussion is the second variety of the Discussion Mode. The object of this variety is to add to discussion the help of demonstration without destroying discussion. It is, therefore, different from the discussed demonstration in which discussion helps demonstration.

As an example of this variety we may take the case of designing and making a new type of tray. Before beginning the discussion at all the teacher may show the pupils several kinds of trays. This preliminary experience with trays will give the pupils various ideas, and in the discussion that follows many pupils will be able to make suggestions derived from their observations. By this means a new type of design may be developed. As another example we may take the case of composing a poem. As soon as discussion begins, it may be found that the majority of pupils are not sufficiently familiar with examples of the type. In this case the discussion should stop until the teacher has made the pupils familiar with a number of good examples. Then the discussion should be resumed and a plan made. As a third example we may take the case of carrying out research. Rather than discuss with the pupil at once how to carry out the research, it is much better for the

teacher to cause the pupil to make himself familiar with similar researches. This will give the pupil suitable ideas for discussion.

The explained discussion

The explained discussion is the third variety of the Discussion Mode. In this the teacher endeavours to combine the advantages of the lecture with the discussion while at the same time making discussion dominant.

As examples we may consider the following. Before discussing with his pupils how to make a medicine chest suitable for a particular school, the teacher may give a talk on types of medicine chests with which he is familiar. A preliminary talk of this nature will greatly facilitate the invention of a type of medicine chest suitable for the needs of a particular school. Similarly if the intention is to compose a new school song, the teacher may give a talk on school songs, quoting examples. As a rule it is only after he has done this, that he will be able to have a useful discussion on the particular song he desires. In the same way if a teacher wishes a pupil to undertake a geographical investigation of his neighbourhood, it will be advisable for him to give a talk on how others have carried out such investigations and thus, through discussion, furnish material suitable for adaptation to present needs.

The place of the talk or lecture may be taken by a book. In this case the teacher will give references for the pupils to read up before the discussion on the new enterprise begins. If the teacher constantly keeps in mind that the object of discussion is to facilitate investi-

gation, he will be able to help by showing and telling. Overdoing either of these will have the effect of destroying the spirit of investigation.

Summary

We may summarize this chapter as follows: The third mode of helping the pupil to acquire knowledge is the Discussion Mode. This is the right mode for helping the pupil to develop the ability to invent, create and discover. For this purpose he engages in investigations of two kinds, projects and problems, the former concerned with doing and the latter with thinking. The varieties of the Discussion Mode are the simple discussion, the demonstrated discussion and the explained discussion. Discussion used by itself may be free or controlled. The conversation and the conference are examples of free discussion, while the Herbartian method and class discussion are forms of controlled discussion. An important variety of controlled discussion is the socialized discussion in which the control is handed over to the pupils themselves. Of all these forms of controlled discussion teacher-controlled discussion is the best for normal use. The demonstrated discussion is very helpful when pupils are not familiar with real examples of the kind of investigation they wish to undertake. The explained discussion enables the teacher to give the benefit of his experience in an organized form before and during the discussion.

In all forms of discussion the teacher should remember that the object of discussion is to facilitate investigation. He should also see that all members of the class get a

reasonable opportunity to take part in discussion and that they are treated with courtesy.

QUESTIONS AND EXERCISES

Enumeration

1. Name the varieties of the Discussion Mode.
2. Name two disadvantages of the Discussion Mode.
3. Give five maxims in regard to the use of questions.
4. Name the varieties of discussion.
5. Name two different types of pupil activities that may be made prominent in a socialized discussion.

Completion

1. There is danger of desultory conversation in the . . . Mode.
2. Discussion methods provide opportunities for
. . . and
3. Some teachers fall into the habit of unnecessarily
. . . answers or of . . . answers.
4. A teacher who has difficulty in maintaining discipline should not use the method.
5. . . . pupils may sidetrack discussion.

Right or wrong?

1. In discussion lessons textbooks should never be open.
2. The socialized discussion method gives training in leadership and initiative.
3. The more questions you can ask the better.
4. In general you should ask questions which can be answered by 'yes' or 'no'.
5. It is not wise to 'pump' answers from pupils.
6. In discussion both teacher and pupils ask questions.
7. All questions are thought-provoking questions.
8. The object of discussion is conversation.
9. Demonstration has no place in discussion.
10. Discussion helps invention.

ADDITIONAL QUESTIONS AND EXERCISES

1. Give five examples of the deficiency of problems in some part of school work.
2. In what part of the school may the Herbartian method be used?
3. What are the advantages and disadvantages of socialized procedure?
4. What are the social values of debate? How much controversy should be allowed between pupils?
5. What was the most natural and most interested class of which you were ever a member? To what extent was it a socialized class?
6. Which do you believe the more effective method for use in teaching your subject—the formal or informal discussion?

CHAPTER IX

FIXATION

WE have so far examined the first phase of learning and the first phase of teaching in which the teacher helps the pupil to acquire knowledge. We have now to examine the second phase of learning and the various ways in which the teacher can help at this phase.

We shall first consider when fixation does occur and then the factors that make fixation possible, reserving for later chapters the various modes of fixing.

When fixation occurs

As we have seen, the phases of learning are not necessarily steps. Consequently fixation may occur along with the first phase, with the third phase or independently. We may illustrate this as follows: in teaching the Mediterranean type of climate it may happen that fixation of the principle, and of the important facts, may be seen to have taken place when the first phase has been satisfactorily completed. Again, if the analysis of a musical composition has been done with the help of frequent presentations of the piece, it will be found that by the time the first phase is finished, the second also has been finished. In these examples the first and second phases of learning take place more or less simultaneously. The following are examples in which fixation takes place at the same time as application. Suppose the task is to

learn how to make a summary. The teacher briefly explains the method but the fixing of the method will take place while the pupil practises making summaries. Again, when a pupil learns to play a piece of music, he may find out what to do, fix the knowledge and gain the ability to play all at the same time by actually trying to play. As examples of fixation done independently and at a separate step, we may take the learning of the multiplication tables. At the first step the child is made to build up the tables and thus understand them. At a special second step he is made to fix the multiplication facts by memorizing them. The lesson on the Mediterranean type of climate may also be treated in this way. After the facts have been discussed and understood the teacher may undertake a review lesson specially to fix the facts. As a third example we may take the case of fixing with the help of a practice exercise. Suppose the teacher has explained and demonstrated to a pupil how to bisect an angle by cutting off equal lengths AB , AC along the arms of the angle ABC , constructing equal circles with centres B and C , allowing them to cut at P , and finally joining P and A . The pupil may be helped to fix this method by making him practise bisecting angles of different sizes.

If we represent the three phases of learning, namely acquisition, fixation, and application of knowledge, by the letters A , B , and C , then the possible combinations of B with each of the phases A and C are AB and BC . B may also occur independently and in combination with both the others but the last does not need special attention here as it is a special case of either AB or BC .

Factors of fixation

The chief factors of fixation are repetition and organization.

(a) *Repetition*: The value of repetition depends upon the Law of Retention which has been formulated by Spearman as follows: 'The occurrence of any mental event inclines it to occur subsequently.' The classical example is that of a creased piece of paper; ever afterwards that paper will incline to re-crease along the same lines. This example is drawn from the physical world, showing that the law is not limited to mental events. Illustrations from the mental field are facility in repeating the multiplication table after repetition and easy reproduction of facts after a review lesson.

Ebbinghaus and other experimental psychologists have pointed out how quickly forgetting takes place. In the case of poetry one experimenter found that after an hour about twenty per cent was forgotten; after five days almost half was forgotten and after fourteen days seventy per cent; after that the loss was gradual. Many experimenters have established the general fact that the curve of forgetting shows a sharp initial fall and that after about two weeks very little is left in the mind. The rapidity of forgetting is often not realized by teachers, although they could easily ascertain the fact for themselves by attending public lectures and seeing how much they remember at the end of each lecture after a day or two.

Repetition is one of the chief means of counteracting forgetting. Several important facts have been found out in regard to economical repetition. One is in

regard to the number of repetitions. It is that the number of repetitions must be more than what is necessary for bare recall. Repetition must be continued until one can recall easily. The multiplication facts must be repeated as often as necessary for easy recall before they can be said to be properly fixed. A second point is that repetitions with interest and attention are more successful than others. It is well known that children interested in cricket or motor cars can easily recall a surprising number of facts about them. Another very important fact is that active recall after a certain time is better than passive repetition. Instead of reading over and over again a list of formulas after they have been understood, it is better to try to recall them without referring to the book; other important facts refer to the intervals between repetitions and to the quantity that should be repeated at a time. Distributed repetitions, that is repetitions with intervals between them, have been found to be more economical than massed repetitions. Drill in spelling, therefore, is better done a few minutes at a time than continued through a long period. In regard to quantity, the whole method—provided the whole is not too large—has been found to be better than the part method. It has been found, for instance, that a short poem is better memorized as a whole than verse by verse. It has also been found that the progressive part method is sometimes better than the whole method. In the progressive part method verse 1 is memorized first, then verse 2, then verses 1 and 2, then verse 3, next verses 1, 2 and 3 and so on. The last important fact that we have to note about repetition is that repetitions

attended with satisfaction are fixed much more easily than those that are not so attended. Hence repetition has to be made interesting. A child will succeed in memorizing a poem more quickly if somebody encourages him than if he gets no encouragement. An adult will be able to master a piece of music more rapidly if he feels he is making progress than if he does not. As we shall see later, teachers have found out many methods of making repetition interesting and satisfying.

(b) *Organization*: The second factor in fixation is organization. From the learning point of view this involves the education of relations as that is the usual means of constituting wholes. How this happens will become evident if we repeat the same sort of experiment as we have already carried out. In this type of experiment the subject has to memorize a list of words arranged in two ways:

The two arrangements of a certain list are as follows:

(a) Spain, Abyssinia, oranges, Magellan, Africa, money, Italy, radio, £. s. d., Marconi, America.

(b) Radio, Marconi, Italy, Abyssinia, Africa, America, Magellan, Spain, oranges, money, £. s. d.

If the reader goes through the second list once, noting the connexion of each with the next he will find that he can repeat the whole list with ease; but one reading of the first list will not enable him to recall many words. The words of the second list become organized but those of the first list do not.

Disconnected items can be made into connected wholes

with the help of mnemonics, that is, by connecting them with something which makes an easy though artificial whole. Thus the chief colours can be remembered in their order by making a word with the first letters. The word 'vibgyor' will enable one to recall the colours in their proper order: violet, indigo, blue, green, yellow, orange, red. Another mnemonic device is to cast disconnected items into verse form as verses are easily memorized because relations between rhythmic feet and rhymes are easily seen and because they are interesting.

An example is the following well-known rhyme:

Thirty days hath September
April, June and November.
All the rest have thirty-one
Excepting February alone
Which has but twenty-eight days clear
And twenty-nine in each leap year.

Mnemonics are important only for memorizing disconnected facts. In the case of meaningful material essential relations should be thought out. There are various ways of doing this. A good plan with reading material is to make a rapid survey to find out the main outlines of the chapter or book, then when reading carefully one may try to recall the important points, and finally make a summary. Another device is to underline important words, taking care not to underline other people's books. Still another plan is to make extracts and file them in some methodical manner. It is also important to maintain a critical attitude and to consider whether statements in books are true or false. In

listening to a lecture it is a good plan to make notes of the outline and to take down a few important illustrations. It is also a good plan to read up the notes as soon as one gets home and to expand them if possible into an essay. These are all individual methods. They should be supplemented whenever possible by discussion. To discuss the contents of a book with a friend is one of the best ways of organizing and fixing the material read, as it helps one to look at the material from different points of view and to connect it more securely with past knowledge.

Whipple's¹ advice to students preparing for examinations may with advantage be quoted here for the benefit of students preparing for examinations:

- (a) With the aid of the underlined paragraphs of your textbook, and your outlined lecture notes review the work in such a way as to tie it together into a systematic organized whole.
- (b) Begin this review at least a week, better two weeks, before the examination. Don't rely on last minute 'cramming'.
- (c) After completing your review, try to anticipate questions you will be asked. Get others to join you in this anticipatory quizzing.

Summary

The second phase of learning is fixation. Fixation may occur simultaneously with the acquisition or application of knowledge or independently. The factors that make fixation possible are repetition and organization. These

¹ Whipple, *How to Study Effectively*.

are necessary because forgetting is very rapid and very little is usually remembered after a comparatively short time. Repetitions should be frequent but too many should not follow each other. They must be continued until easy recall is possible. The attempt to recall also helps fixation and one must give one's mind to repetition rather than do it half-heartedly. The more satisfied we are with our work, the more successful will be the repetition. Organizing consists in thinking out relations. Mnemonics are artificial ways of connecting disconnected material. With meaningful material connexions should be thought out in a methodical manner. The material of a book should be organized by finding out the outline, by noting the details and by making a summary. In listening one should make notes and develop them without too much delay. One of the most important ways of organizing material is discussion with others.

QUESTIONS AND EXERCISES

Enumeration

1. Name two ways of fixing.
2. Give three examples of the Law of Retention.
3. When does fixation occur?
4. What is the form of the curve of forgetting?
5. Quote a rhyme which helps memorizing.

Completion

1. Mnemonics are only important for memorizing . . . facts.
2. In reading a book the first thing to do is to get an idea of the . . .
3. Repetition must be continued until one can recall . . .
4. . . . is one of the chief means of counteracting forgetting.
5. After a certain time there should be an attempt at . . . recall.

6. In reviews material once studied is gone over for the purpose of . . .

7. The chief factors of fixation are . . . and . . .

Right or wrong?

1. Fixation is the second step in learning.

2. In an hour we forget about fifty per cent.

3. Repetitions with interest and attention are more successful than others.

4. The whole method is in general better than the part method.

5. Satisfaction strengthens fixation.

6. In taking notes of a lecture one should write down the outline only.

ADDITIONAL QUESTIONS AND EXERCISES

1. When all the class show inadequate fixation of facts, how would you proceed to deal with the situation?

2. Would it be well to memorize the demonstration of a difficult proposition in geometry after it is thoroughly understood?

3. Is it necessary to have spelling lessons daily?

4. How may retention be improved?

CHAPTER X

THE DRILL AND REVIEW MODES

IN this chapter we shall deal with the two principal modes of fixation. In each mode either repetition or reorganization may be dominant but usually both are present. The two chief modes are the Drill Mode and the Review Mode. In the first repetition is dominant and in the second reorganization.

An example of the Drill Mode is the fixing of the facts of the multiplication table by repetition. Here the main work is repetition, but understanding and reorganization are not excluded. They are, however, subordinate since they should have been dealt with adequately at the first phase of learning. An example of the Review Mode is fixing the causes, details and results of the Great War in a review lesson. Here a second reorganization supplements the organization made at the first phase of learning. Such reorganization is necessary with complex material to enable the pupil to make it his own by reorganizing the material to suit his past knowledge.

In reorganization there is repetition but it is subordinate to the main work. We shall now proceed to describe the two modes of fixation in greater detail.

The Drill Mode

In this mode the teacher's aim is to help the pupil to fix his knowledge by repetition in such a manner as to be

able to reproduce it correctly and quickly. For this he may use either drill exercises or drill questions.

(a) *Drill exercises.* As an example of the use of reproduction exercises we may quote the way in which a teacher helped his pupils to fix the facts of the multiplication table.¹

‘To help my pupils of Standard III to revise the tables, I have made number wheels. These consist of larger and smaller circles of paper. Both circles are fastened together with a paper fastener through the centres, and one lined off into twelve spaces, then coloured, each space of a different shade. All numbers up to 12 are then written (in any order) on both circles, with the multiplication sign after the one on the smaller circle. A child commences working at a certain colour and works the little sum, $7 \times 9 = ?$ or whatever it may be. This, with the answer, is written on a slip of paper provided for the purpose. The child works round the wheel and so completes 12 sums. The smaller circle is then moved round one degree and the process repeated. Each wheel provides a gross of sums. Ten minutes are given at the beginning and end of an arithmetic lesson for this work. Then papers are changed and the children correct each other’s work, thus again revising the tables. The papers are kept in the arithmetic books, and can be glanced through by the teacher after being corrected by the children.’

As another example we may take the case of fixing spelling by means of a contest. In this method the

¹ Extract from *The Teachers’ World*.

pupils are divided into two groups. One pupil from one group asks a pupil of the other group to spell a word. If that pupil fails he has to go over to the winning side. If he succeeds he remains where he is and has the right to ask one of the other group to spell another word and so on.

As a third example we may mention the use of flash cards by means of which pupils are drilled in recognizing sentences correctly and quickly. The same sort of drill exercise may be used in history and geography with pictures. Pictures of historical buildings and aerial views of important towns and districts may be used in this way.

Drill exercises were once fashionable in history and geography but are not so now. This reminds us of the extremes to which educational theory often tends. At one time drill and rote learning are the order of the day. At another time drill is cast aside and review and re-organization are used exclusively. The truth, of course, is, that we need both drill and review. Therefore, such drill exercises as pointing to places on the map or to events on the date chart badly need reviving at the present day.

(b) *Drill questions.* The first and best known variety of this mode is that known as the rapid-fire question and answer method. In this the teacher asks memory questions such as: 'What is the capital of England?' 'What is the river on which it stands?' 'From what hills does the river rise?' 'In what latitude is London?' The main purpose, which is reproduction, should be constantly kept in mind by the teacher.

Nothing but the entire fact asked for should be accepted.

This method is used in the wrong way if the teacher spends the greater part of the time in explaining and adding further information. Many teachers are in the habit of completing and amplifying the imperfect answers of pupils. The question may be legitimately used in this way if the purpose is review and even then explanation should be used only so far as it will help reorganization. On account of the fear of the Drill Mode of teaching that many teachers have, they tend to convert the drill question into a review question. If it is drill that they wish to do, then they should work deliberately and openly for that end. In using the rapid-fire question and answer the teacher should plan beforehand what items he means to drill on, and he must take care to distribute his questions satisfactorily, not neglecting the pupils at the back or at the sides of the room. He must also guard against forming mannerisms such as echoing answers and completing answers.

In regard to the technique of both drill exercises and drill questions the most important point is the necessity for interest. On this matter Stormzand in his *Progressive Methods of Teaching* writes as follows:

‘The difference between the successful and unsuccessful teacher in this type of work is marked by the extent to which study and ingenuity is expended in collecting and inventing devices for introducing variety. The compelling drill master, who persists in monotonous, uninteresting regularity of method gets no more happiness out of the day’s work than the poor victims. The

humane, thoughtful teacher devotes himself to all the varieties of motivation.' Another important point is that as a rule drill periods should be short and should not exceed at the most thirty minutes. It is also important that there should be frequent drills. Handwriting and pronunciation drill exercises, given for a few minutes at the beginning of each school day, will yield remarkable results. It is important that pupils should be drilled only in correct forms. They should not be allowed to repeat wrong forms, as once fixed they are very difficult to get rid of.

The Review Mode

The purpose of the review is to organize material so that it is firmly fixed and can be reproduced correctly and quickly. At the first phase of learning, an organization would have been built up. The purpose of the second step is to help the pupil to reorganize the material himself, so that it becomes his own and combines with his past knowledge. Repetition necessarily occurs but is subordinate to reorganization.

Two varieties have to be distinguished viz: review exercises and review questions. In the former the pupil is asked to express the results of his reorganization in overt action, in the latter in words.

(a) *Review exercises.* As examples of review exercises suitable for the lower classes we may mention the making of models. In geography after reading about Red Indians small pupils should make a wigwam. Of course, the planning should be mainly left to the pupils. If the teacher does the work the pupils themselves will

not organize their knowledge. Other examples are making a boat with paper or plasticine, and drawing a picture to illustrate a story. This type of work is often called expression work in the kindergarten. Its great value is that it helps the child to examine his ideas and reorganize them. The following review exercises are suitable for middle classes: After reading the description of a battle, making a plan of the arrangement of the forces; after studying geographical facts making sketch maps; representing a historical event by a tableau, in which a group of pupils represent a historical scene or incident in suitable costumes and attitudes, silent and motionless. In the upper classes dramatizing may be attempted. The play should be worked out mainly by the pupils themselves for otherwise there would be little reorganization of their knowledge. It is the constructing of the play, not the performance, that is crucial in this kind of review. For successful use of this method teacher and pupils must know a few facts about play-writing such as the use of the dialogue, the division of a play into acts and scenes, etc. It is also necessary to see that all pupils participate in some capacity or other and, in general, the performances should be informal, not involving the use of elaborate stage setting and costumes. Dramatizing used as a method of review should be carefully distinguished from the preparation of a play for public performance. In the former the planning of the play is the main thing; in the latter the performance. Other review exercises suitable for the upper school are imaginative letters and diaries. Thus after studying the siege of Calais a pupil may be asked to imagine he is a

soldier who took part in the siege, and to write a letter to his mother, giving an account of it; or a pupil may be asked to imagine himself a traveller and to write an account of his travels in a foreign country. Making imaginative voyages is a very useful form of review of geographical material.

(b) *Review questions.* As the purpose of review is to enable the pupil to organize his knowledge, the rapid-fire question and answer method is quite unsuitable for it, as it does not give the pupil any opportunity for organizing his knowledge. Many teachers seem to be unaware of the uselessness of this method for review, making no distinction between drill and review.

A better method is the topical recitation method in which the pupils have to make short speeches lasting three or four minutes. A speech of this duration ensures that some time is spent in thought and also gives valuable practice in speaking to an audience. The disadvantage of this method lies in the fact that a pupil may say nothing new and thus lose the attention of the class. But if original examples are demanded, this disadvantage can be to some extent reduced. To use this method successfully the teacher must set suitable thought-provoking questions. They may involve comparison; for example: Compare the policy of Bismarck with that of Cavour. They may be evaluation questions such as: 'Estimate the importance of the reign of Peter the Great'; 'Estimate the importance of the work of Kemal Pasha for Turkey.' They may require summaries, and so on. Such questions should be given in advance so that the pupil may have an opportunity of preparing answers.

The teacher should take care to treat answers sympathetically as most pupils tend to regard the topical recitation as a trying test.

Another method slightly different from the above is the method of reporting. In this the pupil (or group of pupils) prepares a report on a given topic as well as any needed apparatus, such as maps and models, and presents the results of his work to the class.

Still another method is what is known as the doctor's examination in America, in which after a brief summary of the principal points of the work assigned, the pupil stands ready to answer any fair questions put to him.

In addition to the above methods there is the class discussion in which the discussion is guided by the teacher, and the socialized discussion in which the control of the discussion is deputed to the pupils themselves. Free discussion in optional groups may also be successfully used with advanced classes.

Summary

The two modes of fixing are the Drill Mode and the Review Mode. In the former repetition is dominant, in the latter organization. The first is necessary for fixing disconnected material and the second for fixing connected material. In both modes exercises and questions may be used. Drill exercises help the pupil to fix knowledge with the help of action. Drill questions help him to fix facts directly. The rapid-fire question and answer method is the usual variety of this method. Drills must be short but frequent. They must also be made interesting. In review exercises the action itself is of less impor-

tance than the organization of thought. In expression work the important thing is not the skill shown by the learner but the organization of his thoughts. The rapid-fire question and answer method is unsuitable for review work. Better methods are the topical recitation, the report, class discussion, socialized discussion and free discussion. All review questions must be of the thought-provoking variety to enable the pupil to organize his thoughts.

QUESTIONS AND EXERCISES

Enumeration

1. What is the process that is dominant in the Review Mode?
2. Give an example of the Drill Mode.
3. Give an example of a review lesson.
4. Name a device for fixing multiplication facts.
5. Name a device suitable for fixing geographical facts.

Completion

1. Educational theory often tends to go to
2. . . . questions are suitable for fixing.
3. The teacher should guard against . . . and . . . answers.
4. The purpose of the review is to . . . material.
5. . . . work helps the child to examine his ideas and reorganize them.

Right or wrong?

1. In dramatizing for review, the performance is more important than the preparation.
2. Imaginative letters are suitable review exercises.
3. Rapid-fire questions are suitable for review.
4. The topical recitation method is useful for drilling.
5. Reporting and the doctor's examination are suitable review exercises.
6. Discussion helps organization.

ADDITIONAL QUESTIONS AND EXERCISES

1. Is it better in memorizing to read a selection of, say twenty lines over and over until it is all memorized, or to read it and memorize it line by line?
2. What are the factors that determine the rate at which questions should be asked?
3. Why has drill fallen into disrepute among many teachers?
4. Give five examples of faulty review.
5. What is the value of an outline prepared by pupils as a part of their review work?
6. Would you be willing in a review of a large topic in history to demand fewer details than in the original study of the topic?
7. What is meant by saying that a review should mean a new view?
8. How often should reviews be conducted?
9. What are the advantages and disadvantages of setting apart a fixed period, such as the last three weeks of the term, for a formal review?
10. Name the subjects or parts of subjects in which drill work is essential.
11. Name some of the motivating devices which you have used in drill work, and justify their use.
12. A teacher who spent a large part of her time making the class recite the multiplication tables in concert was surprised to find that the majority of the class did not know the tables when examination time came. What was the explanation?
13. In a school where the children had a thirty-five-minute period for a writing lesson, the results during the last ten minutes were poorer than during the first quarter of the period. What is the explanation?
14. How can you know when it is wise to discontinue drill work?
15. Do you think it necessary to plan for a drill lesson?

CHAPTER XI

APPLICATION

WE have now reached the third phase of learning—application. We shall first examine the meaning of application, then consider when application takes place and finally deal with the chief kinds of application, leaving to later chapters the description of the practice and correction of application exercises.

The meaning of application

According to the dictionary the meaning of application is 'putting of one thing to another' or 'making use of'. The thing that is put to another or made use of in the process of learning is *knowledge*. Thus each time we work a multiplication exercise we apply our knowledge of the facts of the multiplication table. Again, it is by using our knowledge of language that we comprehend what others tell us or what is contained in books. In the same way it is because we know what to admire in literature, that we are able to appreciate intelligently good prose and poetry. In inventing a new type of machine the inventor first plans what to do and then puts that knowledge into action. The poet similarly has an idea, vague though it be at first, to which he gives expression in words. The discoverer of knowledge, too, thinks out a hypothesis and proceeds to act on it with a view to correcting or confirming it. From these examples we can

see not only that application always involves using knowledge but that it is also an action which is subsequent to the acquiring of knowledge.

When the teacher desires the pupil to use his knowledge he sets application exercises, which demand the use and not the acquisition or fixation of knowledge. These exercises have to be distinguished from drill exercises and review exercises whose object is not the application of knowledge. When the teacher drills the pupil in locating places on the map, the physical act of showing is not the important thing but the fixing of the knowledge of locations. When the pupil uses the two-wheel device for mastering the facts of the multiplication table, it is not the act of turning the wheels that the teacher hopes to improve, but his knowledge of the multiplication facts. When review takes the form of expression-work it is obvious that it is organization and not skill in drawing or woodwork that the teacher aims at. Fixation exercises must therefore be distinguished from application exercises.

In the first and second phases of learning it is knowledge that the learner is concerned with. At the third phase the character of the learning changes from knowledge to action, from acquiring knowledge to using knowledge, from knowledge by itself to knowledge in action. The contrast between knowledge and action is the same as between theory and practice. A theory is a system of ideas which exists only in the mind while practice is a doing which exists in the field of action. The same contrast is present when we compliment a person as being practical. We mean that in him thought does not

overbalance action. When we use the word in a disparaging sense we mean that the person is good at acting but not at thinking.

Application, then, in learning and teaching, means action governed by knowledge.

When application occurs

As we have already seen, the phases of learning may occur simultaneously or at different times. In one-step learning all the three phases occur more or less together. In Cizek's method of teaching drawing, the pupil is asked to draw whatever he likes, and learning consists in acquiring knowledge, fixing and applying it for the purpose of improving the original application. The learning began with application since the pupil had to use his past knowledge to draw anything at all. In this way of learning it may be said that all three phases of learning take place more or less simultaneously. In two-step learning application may occur with the second phase of learning. After explaining how to work a certain type of sum, the teacher may set the pupil a number of exercises similar to the example explained. Here the fixation of the method as well as its application take place more or less simultaneously. In three-step learning application occurs as a distinct step. Thus the story of the Great War may be first understood, then fixed in a review lesson and finally applied in the process of doing suitable application exercises.

Habitual and constructive application

A very important division of applications is into habitual

and constructive. This corresponds to the classification of abilities into habitual and constructive.

Habitual applications are accustomed reactions, not requiring much deliberation. They may involve skill, appreciation or comprehension. Examples of skills are handwriting and pronunciation. In the ordinary course of things when we apply our knowledge of handwriting or pronunciation we do not have to deliberate. They are habitual actions. Similarly when we have learnt to appreciate one type of poem we can appreciate a similar poem applying our knowledge in a habitual manner, without having to make an investigation. In the same way when we have once understood a machine, we can reproduce our past knowledge and understand a similar type of machine easily.

Constructive applications in all cases require investigation or deliberation. If we are not already experienced in chair-making, we have to plan how to do it. If we do not know how to compose a poem, we have to think it out before we can produce a suitable result. Similarly, a problem, facing an unaccustomed situation, requires thought for its solution. Constructive applications themselves require the three phases of learning. They may, therefore, be regarded either as one-step learnings or as examples of the third step in a larger learning process.

Real and formal applications

A second very important division of applications is into real and formal. Applications are real, as we have already seen, only when they involve a real life purpose, that is, some purpose other than that of preparation for

real life application. Thus to write a letter to a friend because the pupil wishes to keep in touch with him is a real application because it has a real purpose other than preparation. But to write a letter to another person not because the pupil needs to keep in touch with him, but because the teacher tells him to write, is not a real application because the writing of the letter is not for a real life purpose but only for the improvement of the pupil's ability to write letters. To make a geographical survey of one's neighbourhood simply because the teacher requires one to do so does not constitute a real application. It will only become that if some real purpose is to be served by it.

Opportunities for application are greatest when we are interested. The view that all the genuine interests of man are inborn is fallacious. Many of them are acquired. W. McDougall in the *Energies of Men*¹ says: 'An adult man's interests are almost every one of them intensely artificial: they have been slowly built up. The objects of professional interests are most of them, in their original nature repulsive, but by their connexion with such natively existing objects as one's personal fortune, one's social responsibilities, and specially by the force of inveterate habit, they grow to be the only things for which in middle life a man profoundly cares.'

Since interests are largely acquired, the conditions of their acquisition are of importance to both learners and teachers. The most important condition is that the learner should try to exert activity towards them. To

¹Methuen, 1932.

exert activity in the normal way in real life situations, as those who have already acquired genuine interests do, is too difficult for the beginner. Hence the necessity for simplification ; but when applications are simplified they become formal, being directly useful only for improving the pupil's abilities. In one kind of formal application the simplification is effected by substituting for real action verbal action. These may be called substitute exercises. Examples are: in geography an imaginary journey instead of a real journey or excursion ; in nature study an imaginary life of a butterfly instead of a real observation of the life history of a butterfly. In arithmetic verbal problems instead of situations really faced. In science verbal problems on levers whose lengths, etc., are given instead of problems with actual levers.

In another kind of formal application the simplification is effected by the breaking up of real activities into simpler activities, and thereby giving practice in the partial activities so that the whole may be attacked more easily later. The following are examples: In handwork one may practise making joints, making a groove, planing, cutting with a saw and horizontal paring with a chisel. In language one may practise converting statements into questions, positive statements into negative statements ; commands into questions ; analysing and parsing : in drawing, copying ornamental units, object drawing and free-hand drawing. In history and geography one may contrast and compare the features of one country or of one event with another. In all these cases the complexity of reality is divided into

parts, enabling us to master each part separately. These applications may be called partial applications.

In a third kind of formal application the real action is not done part by part but in miniature, that is, on a reduced scale. For example: instead of cultivating a paddy field, cultivating paddy in a small plot, making a toy chair instead of a full-sized chair, writing the outline of a play instead of a whole play, appreciating an abridged story instead of the complete story.

It may be said that the principal formal applications are substitute, partial and miniature applications. There is no doubt that these are a valuable approach to real application but teachers have often made the mistake of thinking that learning ends with formal applications. Under such conditions a pupil who did only formal exercises at handwork might gain the impression that the aim of handwork teaching was ability to make such formal applications only. Parsing and analysis have often been done as if they were ends in themselves without any relation to the real use of language. Perspective drawing and object drawing have been studied as if the aim of teaching drawing was to enable the pupil to acquire these formal abilities.

Some of the reasons for the neglect of real applications are the following: Real applications cannot be easily kept within the bounds of traditional subjects. The subject arrangement of material is an abstraction from reality convenient for the economical acquisition of knowledge, but it is an arrangement that does not fit real application. It is only in the abstract that the traditional partition of subjects is valid. When the pupil

attempts a real application of knowledge such as making a set of tubes which will produce the notes of the diatonic scale he needs not only a knowledge of physics but also the various bits of knowledge about metals and about instruments that a real maker of such tubes has. Another reason for the neglect of real application is that it takes a great deal of time. Assemblies and concerts give opportunities for many real applications but every teacher knows how much time they take. Still another reason for the neglect of real application is the substitution of the aim of passing examinations for the real aims of learning, which are the acquisition of abilities of various sorts for use in real life. It is well known, for instance, that a pupil may successfully prepare a number of pieces for a music examination, pass an examination satisfactorily, and thereafter take no further interest in music and allow the piano at home to lie idle. Again it is common knowledge that many teachers attend health courses and obtain certificates but in their private lives make no real application of the principles of health. That the majority of schools should change their ways and introduce real applications is self-evident. But it is not necessary that formal application should be altogether given up.

The general experience of project schools which are based on real exercises is that fixation tends to be neglected owing to the pressure of the real activity. Thus in one school under the project method, the pupils built a little house which the school needed. In the course of the construction they had to understand and make use of the square measure. A few months after the

completion of the house hardly a child knew anything about the square measure. A first-rate teacher would not have allowed this to happen but unfortunately all teachers are not first-rate.

As usual in educational theory the pendulum has swung from one side to the other, and some teachers wish to use nothing but real applications. From some schools perspective drawing and object drawing have been completely abolished. Schools which teach handwork are afraid to ask pupils to make joints. Copy-writing is not allowed in many schools. This reaction shows an insufficient understanding of the relations between formal and real applications. The aim of formal applications is to facilitate real applications and if the aim is kept in mind such applications have a very important place in teaching. We need both formal and real applications in school.

Summary

In the third phase of learning the pupil has to apply knowledge. At this point learning changes from knowing to doing. But the knowing need not always be completed before the doing begins. In one-step learning they occur together. They are distinct in three-step learning. Applications are not only habitual and constructive, requiring little thought or much thought but also real or formal. Real applications are in their natural life-setting and involve purposes other than that of preparation for real life application. The principal formal applications are substitute, partial and miniature applications. Substitute applications retain the form of

the activity but not the medium. Partial applications are parts of complete applications and miniature applications are complete applications in miniature. Formal applications are helpful ways of preparing for real applications. It is a mistake to rest satisfied with formal applications only or to use real applications only but these are extremes to which educational theory usually tends.

QUESTIONS AND EXERCISES

Enumeration

1. Name two essential characteristics of application.
2. Name three kinds of application.
3. Name three ways in which the teacher may help application.
4. Give two varieties of constructive application.
5. Give two varieties of habitual application.
6. Give two examples of habitual application from geography.
7. Name three differences between application and reproduction.
8. Name two differences between habitual and constructive application.

Completion

1. After acquisition and fixation comes . . .
2. All application is necessarily use of knowledge but it is not always . . .
3. Application is possible with reference to all . . . aspects of the human being.
4. Habitual application depends on the principle of . . . and the crucial mental process is that of . . .
5. The crucial process in constructive application is . . .
6. The simplest kind of application is . . .

Right or wrong?

1. When making applications the pupil is using his knowledge.
2. All applications are practical.

3. There is very little chance for any genuine application in the study of history.
4. Application is the purposeful employment of means.
5. Choice is involved in constructive application.
6. Any purposeful school activity should be called a real application.
7. An application is any self-initiated activity of the child.

ADDITIONAL QUESTIONS AND EXERCISES

1. Why is real application so often neglected?
2. Is application an important part of teaching?
3. Are formal applications necessary?
4. Distinguish between habitual and constructive application.
5. Discuss the function of the school assembly.

CHAPTER XII

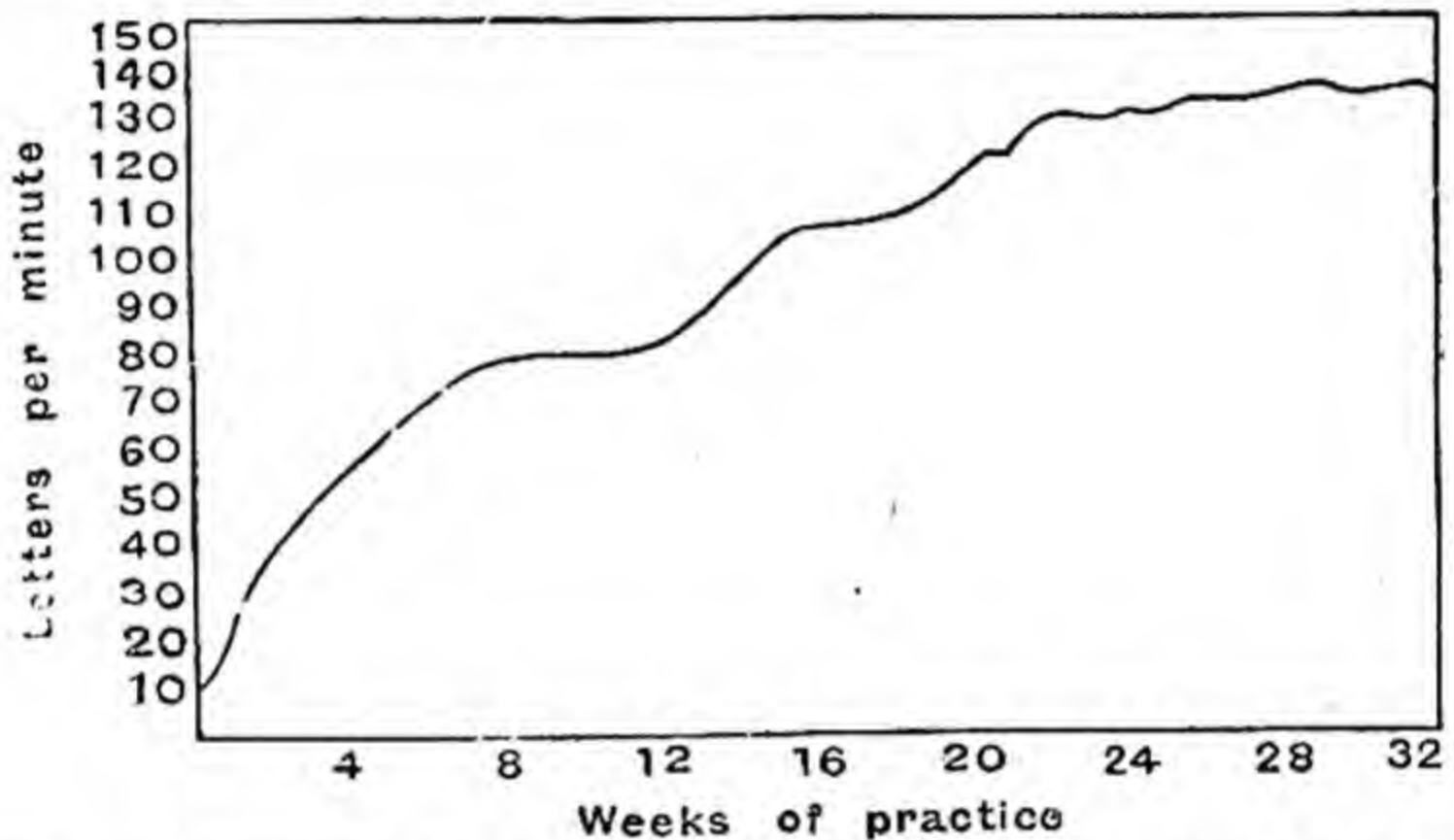
PRACTICE AND CORRECTION

IN this chapter we shall first examine how improvement takes place with the repetition or practice of applications and then how errors are corrected.

Improvement through practice

The aim in repeating applications is to enable one to do the actions correctly and easily. Practice should give both accuracy and speed but at the beginning of practice it is necessary to emphasize accuracy rather than speed. In beginning handwriting the accurate holding of the body, of the pen and of the book are more important than speed in writing. In beginning reading correct pronunciation of vowels and consonants and proper phrasing are more important than speed in reading. As the pupil improves, speed exercises become necessary. In some speed exercises a count can be kept. Silent reading can be measured by counting the number of words read, say, in three minutes. Such exercises are necessary for training in rapid reading, which is useful for getting to know the general outline of a book, or when reading for amusement, but they are not necessary for the teaching of reflective reading, where not speed but comprehension is most necessary. A similar distinction holds good in arithmetic. Speed exercises are necessary in calculations but not for problems.

The course of improvement through practice has been found out by experiment. It is shown on the following diagram which indicates the improvement in telegraphy made by a subject. An examination of the diagram will show the number of letters per minute which the subject was able to send at the end of every fourth week.



*Typical practice curve of improvement in telegraphy after
W. L. Bryan and N. Harter.*

The important points to note in this curve are: (a) that the improvement is rapid at first, (b) that it becomes more gradual and slow as practice continues, (c) that there may occur plateaus, that is, periods in which little or no improvement appears and finally (d) that a stage will be reached where no amount of repetition of the performance results in further gains. A knowledge of this curve enables a person to persevere even though improvement is not as great as at first. It also enables teachers to encourage pupils when they reach plateaus.

The following are the usual maxims in regard to the forming of habits, first formulated by William James, the psychologist and philosopher.

1. Get the correct start.
2. Be attentive in each repetition.
3. Permit no exceptions.
4. Start enthusiastically.

No attempt at practice should be made until the presentation has been correctly understood, as it is much more difficult to eradicate wrong habits than to form right habits. In regard to attention it has been shown experimentally that the less the attention, the less the improvement. Self-control and enthusiasm are necessary because the gains made are bound to be less after a short period of repetition.

Influence of failure and success on application

When an application is attempted by the pupil he may meet with various degrees of failure or success. Thus, he may be attempting to imitate his teacher pronouncing the sentence 'Is it black?' with the correct rising intonation on the last word. He may fail to imitate the intonation but get everything else right. He may also fail to give the right values to the consonants 'b' and 'k'. He may on the other hand pronounce the sentence perfectly correctly. Similarly in doing a problem in arithmetic, he may make mistakes in adding or multiplying but his method may be quite correct. He may also succeed in solving the problem correctly. Again, suppose he is composing a poem. He may fail to find

suitable rhymes but may succeed in expressing his thought in suitable language.

Actual failure and success accompany our efforts at carrying out applications but we may also anticipate failure or success. A pupil may believe, rightly or wrongly, that he is not the sort of person who is good at languages, arithmetic or verse-composition; or he may believe that he is good at these kinds of work.

Failure and success, actual or believed, give rise to certain feelings and emotions which influence the work in hand.

If the obstacle, actually met with or imagined, is one that the pupil thinks he can overcome, he will become more eager to do the work. If the obstacle proves more difficult, he will become anxious and fear that his efforts will not meet with success, causing his eagerness to decrease. If the obstacle proves unsurmountable, he will give up in despair and have the sorrow of failure. On the other hand, if he meets with some measure of success, he will begin to hope and put forth more effort. If he feels that he is really succeeding, he will work with confidence and when the work is finished satisfactorily he will have the joy of success.

Application and emotion are closely connected. A slight degree of failure in application usually spurs to further effort, possibly through the arousal of anger. Greater degrees of failure weaken effort and lead successively to anxiety, fear and despair and finally to the sorrow of failure. Slight success arouses hope, which reinforces effort. Greater degrees of success give rise to confidence which further strengthens effort, while

complete success gives the pupil the joy of success.

The control of these emotions is an important matter for the teacher. The applications he chooses should be neither too easy nor too difficult. They should have just the degree of difficulty that will stimulate the pupil to effort, and this presupposes that he already knows the pupil's abilities and attainments and can therefore grade his exercises suitably. When the pupil is unduly anxious he can encourage him by pointing out that he has not altogether failed, or give the right degree of help, changing anxiety to hope and fear to confidence. In the same way it may become necessary to deal with over-confident pupils by showing them how to make more just estimates of themselves. Ability to control these emotions is a distinguishing characteristic of many successful teachers.

Correction

Correction is a necessary accompaniment of exercises as pupils are liable to make mistakes. Mistakes are of two kinds, mistakes of knowledge and mistakes of action.

In correcting mistakes of knowledge it is necessary to make the pupil see the relation between the correct form and the wrong form. The correct form may be brought to the notice of the pupil by any of the three devices at the disposal of the teacher, by showing, telling, or questioning. Thus if the pupil spells the word 'thief' incorrectly, the teacher may show him the correct spelling. If the pupil makes a mistake in regard to the date of a historical event, he may be told the correct date. If the pupil has a wrong idea in regard to the causes of the

Industrial Revolution, by suitable questions the correct reasons may be elicited.

Merely confronting the pupil with the right form rarely succeeds except in the simplest cases. Each correct form must in addition go through all the phases of learning. Thus in the case of a word like 'thief', the correct form must be understood, fixed and applied in real situations before we can make sure that the pupil will not make the mistake again. If the date of a historical event is wrongly given, the correct date must be found, the facts including the date reorganized by review and applied in some manner. In the case of the failure to understand the causes of the Industrial Revolution, a discussion will help not only correct understanding of facts but also organization of facts. There will remain only the step of application. Trivial errors may be corrected by a process of confrontation but serious errors can be corrected only by a re-learning and re-teaching process.

It is useful to remember that corrections may be either oral or written. The former are more economical of both time and energy than the latter and are also usually more effective. If a written exercise shows the need for numerous corrections, it shows that sufficient oral exercises had not been previously done. What is necessary is not for the teacher to overtax himself by taking exercise books home too frequently but for him to revert to oral exercises. Of course, the teacher must do a certain amount of written correction but this will not become a burden if there has been sufficient oral correction beforehand.

Correction by the pupils themselves, especially by

group discussion, is a form of correction insufficiently used in schools. It can be used to advantage in connexion with all school subjects.

Mistakes of action

Here we are concerned especially with faulty habits. In their correction two things are necessary, checking the faulty habit and fostering the right habit. Both of these are necessary although many teachers tend to use only the one or the other. Thus if a pupil is in the habit of mispronouncing a word it is not sufficient to blame him. He must also be positively encouraged to form the right habit.

The usual methods of checking bad habits are the use of pain, fear and shame. It is nowadays considered brutal to use any severe degree of pain. Minor pains induced by knocks, ear-pulling and rapping over the knuckles are also not popular. Fear of detention and fear of deprivation of privileges are in common use. The former has many disadvantages besides being a punishment for the teacher as well. Deprivation of privileges is often a satisfactory method. Blame can be used as pupils are ashamed to be blamed before others. Sarcasm which goes beyond shame and causes excessive mental pain should be avoided. Making a pupil stand facing the wall or stand on the form are common methods of inducing shame.

The usual methods of fostering good habits are suggestion, play, rivalry, praise and prizes. As these will be dealt with later they will not be described here.

In general it is better to concentrate attention on

forming a good habit rather than on eradicating a bad habit but by some means or other the necessity of forming the right habit should be brought home to the pupil. Once that is done, the remainder is re-learning and re-teaching.

When correction is used, a subsidiary learning and teaching is added to the main teaching as an episode.

Summary

Applications have to be practised or repeated in order that the pupil may gain accuracy and speed of action. When the application is of the habitual order, speed becomes a most important factor but it is less important where applications require thought. The course of improvement through practice has been carefully studied by experimental psychologists. They have shown that there is a rapid rise at first and then less and less until the limit of progress is reached, and that there are plateaus during which there is no apparent improvement. Practice should not be begun until the required action is understood, and it should be continued with attention and enthusiasm and without procrastination. The feelings and emotions that attend success and failure require the special attention of the teacher. Correction is a necessary accompaniment of practice since pupils are liable to make mistakes. In corrective teaching there are two aspects—checking faulty habits and fostering right habits. The first should be subordinate to the second. Each time corrective teaching, which usually involves all the phases of teaching, is done, an episode is introduced into the main current of teaching.

PRACTICE AND CORRECTION
QUESTIONS AND EXERCISES

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Enumeration

1. What should be expected from practice?
2. Name the characteristics of the practice-curve.
3. State maxims helpful in forming habits.
4. Name the two chief kinds of mistakes.
5. Classify correction.

Completion

1. In correcting faulty habits checking and . . . are both necessary.
2. Checking may be done by recourse to . . . or . . .
3. When correction is necessary, re-teaching appears as an . . .
4. Periods in which there is no apparent progress are called . . .
5. Speed is an important factor in . . . application.

Right or wrong?

1. Speed should be emphasized at the beginning of practice.
2. In all practice it is important to get the correct start.
3. Where there is good teaching, correction is not necessary.
4. When a pupil makes a mistake, all that is necessary is to confront him with the correct form.
5. Written correction should precede oral correction.
6. Correction by pupils is very common in schools.

ADDITIONAL QUESTIONS AND EXERCISES

1. Give five cases that have come under your own observation where practice improved accuracy or speed.
2. How can the speed of silent reading be improved?
3. State briefly what you know about practice.
4. Classify mistakes.
5. Classify methods of correction.
6. What is meant by re-teaching?
7. Give an account of the feelings and emotions that are due to varying degrees of success and failure.

CHAPTER XIII

THE FORMAL APPLICATION MODE

IN this chapter we shall examine the exercises that are used for training the pupil in formal application and how they may be made interesting to him. These are the chief activities in the Formal Application Mode.

Formal exercises

The aim of formal practice is to enable a person ultimately to make a real application. Formal exercises may be miniature, partial or substitute exercises. In a miniature exercise the whole action is done on a reduced scale. In a partial exercise an element of a real application is practised separately. Thus handwriting may be mastered by first practising the letters, how to speak a foreign language by first mastering the speech sounds peculiar to the language, how to carry out arithmetical transactions by learning separately addition, subtraction, multiplication and division, piano-playing by practising five finger exercises, scales, chords and arpeggios. When a real action is divided into elements which do not naturally exist by themselves in the world, the elements are abstracted from reality and the purpose of the exercise becomes formal rather than real.

Substitute exercises are not elements of real activities. They take the place of real activities. They preserve

the form but not the medium of real activities. The following are examples: In the teaching of geography, imagining oneself to be travelling from one town to another instead of really travelling. In the teaching of history imagining oneself to be living at the time of the Industrial Revolution and writing a contemporary account of that movement. In the teaching of handwork, making drawings to scale without actually constructing the article itself. In the teaching of arithmetic, doing a verbal problem instead of a real problem. Similar problems are common in the teaching of science. In the teaching of nature study one can imagine oneself a grasshopper and give an imaginary life-history. In the teaching of literature one can substitute for the real enjoyment of literature accounts of other people's observations.

Formal exercises may also be either habitual exercises or constructive exercises. These correspond to habitual and constructive abilities. The following are examples of formal habitual exercises or type exercises in arithmetic. After having learnt how to find 2 per cent of £5, the pupil does the following formal exercises:

Find how much 7 per cent of £125 is.

Find how much $7\frac{1}{2}$ per cent of £250 is.

Or, having learnt how to divide 363 by 127, he does the following formal series:

22,363 divided by 107

233,549 divided by 207

Examples from English are the following: After having learnt how to analyse a simple sentence, the pupil analyses sentences like the following:

'The genuine tramp always avoids hard work.'

'The door led into a small passage.'

'Alice looked along the passage into a lovely garden.'

The following are examples of formal original exercises or formal problem exercises.

From arithmetic :

A number of children were invited to a party. Enough oranges were bought for each invited guest to have two. Some children were absent, so that a quarter of those present had a third orange. What fraction of the children who were invited were present?

From English :

Read the following verse of poetry very carefully :

The boy stood on the burning deck,
Whence all but he had fled,
The flames that lit the battle's wreck,
Shone round him o'er the dead.

Then answer the following questions.

1. How many men and boys were left alive on deck?
2. What could be seen by the light of the burning ship?

From geography :

1. Name an English district where some people mine coal, others work in iron and others make pottery.
2. Name an island in the British Empire where some people grow tea, others grow coconuts and only a few people are white.

Motivation

Formal exercises, like memory exercises, are not

usually interesting. The teacher has therefore, the problem of making this kind of work interesting. The chief methods at his disposal are, suggestion, play, rivalry, praise and prizes and blame and punishment.

Suggestion works through the contagion of interest. If the teacher is interested in Latin, he will often find that his pupils will want to do Latin exercises. If he does not like the subject—teachers do not often like all subjects in the same degree—he will not be able to use this method. (In general the teacher will find that he will have to appeal to several motives at the same time.)

Play is used especially in the lower part of the school where it is particularly useful as it is a motive that appeals to small children.

An example from the kindergarten

The teacher places ten cards on which are written the figures 1 to 10, and ten cards on which are drawn the number groups 1 to 10 in various places around the room. One child comes to the front and asks another child, 'John, what do you spy?' John says, 'I spy with my little eye figure 7', or 'I spy with my little eye group 7'. Then John goes and gets the card, afterwards staying in the front of the class and asking another child, 'What do you spy?' and so the game of 'I spy' goes on. If this game is used as a team game, then players from each team 'spy' alternately.

A spelling game: The players sit round a table. At a given signal, the first player calls out a letter of the alphabet. The next player adds another letter, and so on until a word is completed. Each player must have

in mind an actual word which the letter he adds will help to spell. 'The object is not to finish a word, for, if you do, you have to pay a forfeit and drop out. Of course, the words have to finish sometime, but the player who is left in last wins the game. The player who spells a word wrongly has to pay a double forfeit.'

Rivalry is a motive that is commonly used in schools. The following are examples of the use of this method:

One teacher divided his class into five groups and assigned to each group a star. The group that failed to do their exercises satisfactorily were deprived of the star. This method works best in the lower classes. The stars should be displayed in a conspicuous place in the classroom. Another variant of this method is the Honour Roll. This may be used by putting the names of the boys who have done their exercises satisfactorily on the Honour Roll each week.

Marks are, of course, a well-known method for stimulating competition. The marks gained may be announced at the end of the lesson or the pupils may be made to change their places according to the marks obtained.

Where there are parallel classes competitions can be arranged between them. The same method can be employed by dividing the class into groups.

Praise is a method that the teacher can constantly use. It is a very useful form of encouragement provided the teacher does not allow it to degenerate into flattery. Prizes belong to this category. Occasional use of them is advisable, especially in the lower classes.

Blame and punishment are commonly used by teachers to force pupils to do exercises. These are essentially

methods of correction and have already been dealt with from that point of view, but they have also a small place in the complex of motives that cause action. Some pupils no doubt do their exercises partly through fear of blame or punishment.

Summary

The chief problems that the teacher has to face when using the Formal Application Mode are (a) the choice of suitable formal exercises, and (b) how to make them interesting. Formal exercises are miniature exercises in which real actions are done on a reduced scale or partial exercises in which elements of real activities are practised, or substitute exercises in which a substitute for a real activity is practised. To make these exercises interesting the teacher may appeal to many motives such as suggestion, play, rivalry, praise and punishment. In general he will have to appeal to more than one motive.

QUESTIONS AND EXERCISES

Enumeration

1. What is the aim of formal application ?
2. Name two kinds of formal applications.
3. Give two examples of formal habitual exercises.
4. Give two examples of formal constructive exercises.
5. State five devices for making formal application interesting.

Completion

1. Substitute exercises take the place of . . . exercises.
2. Formal exercises, like . . . exercises, are not usually interesting.
3. Suggestion works through the . . . of interest.
4. Play is especially useful in the . . . part of the school.

5. In general the teacher will have to appeal to more than one . . .

Right or wrong?

1. Substitute exercises are memory exercises.
2. Formal applications contain the essence of real application.
3. It is the teacher's duty to choose suitable formal exercises.
4. Praise is not a good motive for a teacher to use.
5. Blame and punishment are essentially correction devices.

ADDITIONAL QUESTIONS AND EXERCISES

1. How will it affect the pupil's attitude towards a subject if he lacks opportunity for real application?
2. Explain formal application, giving illustrations.
3. Distinguish between substitute, partial and miniature exercises.
4. In what subjects is formal application neglected?
5. How can formal application be made interesting?

CHAPTER XIV

THE REAL APPLICATION MODE

IN this chapter we shall deal with the Real Application Mode. We shall first of all distinguish it from the Formal Application Mode and then deal with its varieties and the part that the teacher plays in it.

Distinction between formal and real practice

The distinction between formal and real practice is that the exercises used in the former are merely preparatory while the exercises used in the latter involve some other purpose. The essential aim of a formal exercise is the improvement of the pupil's abilities while the essential aim of a real exercise is some real life purpose in addition to preparation. An examination of examples will make these points more clear. An exercise like 'Multiply 33 by 35' is formal because its sole aim is the improvement of the pupil's arithmetical ability. Even if the exercise is changed into 'How much will 33 boxes cost at 35 shillings each?' it will still remain formal since there will still be no real need for the calculation other than the improvement of the pupil's abilities. If, however, we have an actual real need to make the calculation, the exercise will become real. Formal exercises are artificial and lack the reality that belongs to real exercises but on the other hand they enable us to simplify and 'divide and conquer' reality. Since formal exercises are more easily tackled,

we can give them greater attention and thus get greater mastery over them, enabling us later to tackle real actions more easily. They have a preparatory value. This is the great advantage that formal exercises have.

It is clear that formal exercises and real exercises should have a satisfactory relation to each other. Only when a real exercise is too difficult for the learner should he be given a formal exercise to enable him to get ready for the real work. If a child in a boarding-school cannot write a letter to his father, he should be given formal exercises in letter writing. But his practice should not be limited to formal letters. He should be given opportunities of writing real letters as well.

It is interesting to note that the project came into the theory and practice of teaching first of all as a real exercise. In agricultural education it became the custom for certain schools in America to supplement the usual class work by assigning real projects to be done at home. Students were expected to do out of school such work as raising a calf, or an acre of corn or potatoes. These exercises are obviously for the purpose of applying knowledge acquired at school.

The project method, it may be said in passing, is not the same as these applications. The project method is a complete method of learning and teaching involving all three phases of learning and teaching. It is a one-step kind of learning and teaching, since all three phases occur more or less together. It has the advantage of starting with a real exercise. Its disadvantages are due to the difficulty of dealing adequately with each

phase of the learning process while carrying out a project. It will be discussed in greater detail in a later chapter.

Varieties of real practice

Just as there was formal practice in both habitual and constructive applications, so there is real practice in both.

(a) Real habitual exercises:

We shall proceed to illustrate first, real habitual exercises. In the field of skills it is fairly easy to think of suitable examples. A real exercise in letter writing is to write to one's parents, informing them of how one is getting on. Another is to correspond with children in other lands. Another is to write a letter to another class challenging them to a match. A real exercise involving arithmetic would be to keep the accounts of the school vegetable garden if it is run on a co-operative basis. A similar account can be kept if the class runs a store. A girl can have a real exercise in arithmetic if she buys and makes her own clothes. Reading at an assembly provides a real exercise in reading. School societies provide opportunities for real use of the facts of history, geography and science. Making small repairs in the school provides real exercises in handwork. In the field of appreciation many real exercises are possible. In music we can attend concerts and appreciate the kind of music we are accustomed to. In art similarly we can visit art galleries. In literature we can enjoy good recitations at concerts, and enjoy dramas at theatres. All these opportunities can be provided within

the school itself if the school holds weekly assemblies and terminal functions. Such assemblies and functions offer opportunities for the application of skill as well as of appreciation. In the field of comprehension also, opportunities can be provided. Newspaper reading affords opportunities for comprehension with the help of knowledge already acquired. If we already know the geography of China and Japan we can comprehend more successfully newspaper accounts of, for example, the Sino-Japanese war. Our knowledge of history can also be utilized in the same way.

(b) Real constructive exercises :

Real constructive exercises are those required for meeting novel situations, which demand thinking. In the field of invention suppose there is no rack for library books in a certain class. The pupils can undertake the enterprise of making a rack to suit the class and its needs. Such an enterprise will show the same steps as a project. The responsibility may be largely left with the pupils since this is a real application. Other examples belonging to the field of invention are planning and making a toolshed that the school needs, making a medicine chest for the use of the school, and cultivating a field. Running a school newspaper or school magazine afford scope for originality in the field of language. Constructive applications in the field of creations are similar to projects. They are such as the following: composing a school song; writing a poem to be read at the school concert, or at the literary society; writing a play or story for reading at a meeting of the literary society or for the school magazine.

Constructive applications in the field of discovery are also possible. Examples are little researches in history, geography and science carried out by the pupils themselves and reported at the meetings of the school societies or published in the school journal.

Other real exercises

Another important division of real exercises is into individual and collective exercises. At a school assembly one pupil may recite a poem or there may be a carefully prepared choral recitation. One pupil may sing a song or the class may sing together. Dramatization is a very useful collective exercise for the real application of language. Even a simple story such as 'Who killed Cock Robin?' can be dramatized by small children, each one taking a part. More ambitious dramas can be attempted by the higher classes.

Real exercises may also involve language, spoken or written, as well as practical action. Recitations and dramas are spoken exercises, school newspapers and magazines written exercises, while making a wardrobe or cultivating a field are practical exercises.

The teacher's part

In the preparation of both formal and real exercises the teacher has a definite part to play. The choice of the formal exercise lies with the teacher as the pupils themselves are not competent to choose suitable formal exercises. In the case of real exercises which are by nature interesting to pupils, they should be given a share in the choosing, but it is not necessary that

all real exercises should be discovered by the pupils. Some may be suggested by the teacher. If a suggestion of the pupils is adopted, it is the duty of the teacher to see that it is a satisfactory one. Not every exercise that pupils think of should be allowed unless it has a formal value as well. Within a certain range the teacher should give the pupils freedom but the bounds must not be overstepped. It is quite possible that some pupils may desire to carry out selfish and unsocial activities. They may also desire to do things that they cannot do and that are of no use to them. In the choice of real exercises the teacher has therefore a definite place. It is his business not only to see that pupils choose in a wise manner but also to suggest real exercises that are suitable and are within their abilities.

Once the exercise is chosen, the next step is the practice of it. Here also the teacher has an important part to play. He has to see that the necessary practice is put in and that the application reaches a satisfactory standard. If the pupils are preparing a school newspaper, the teacher cannot leave the preparation entirely to them. His advice and encouragement should be constantly at the disposal of his pupils. What he needs to remember is that the job has been undertaken by his pupils and that he must not do for them what they can be reasonably expected to do for themselves.

Very often correction may become necessary. On such occasions subsidiary re-teachings have to be done by the teacher.

When the preparation has been finished, the pupils

have to take responsibility for the performance. For example the newspaper they prepared is theirs and a good share of the praise and blame that may attend it should be theirs. So too for the actual recitation of a poem or the actual presenting of a drama the pupils have to take full responsibility because it is they who have to do these, not the teacher.

Summary

In the Real Application Mode the teacher makes use of real exercises. They must have other ends besides preparation. They must also be valued for their own sake. Many real exercises are possible within the school. They may be suggested either by the teacher or by the pupils. It is the duty of the teacher to see that the real exercises chosen are suitable. It is also a part of his duty to help the pupil where necessary, and to do corrective re-teaching if that is also needed. At the final execution the pupil must be completely free from the control of the teacher, since such free application is the natural end of teaching.

QUESTIONS AND EXERCISES

Enumeration

1. Name the characteristics of a formal exercise.
2. Name the characteristics of a real exercise.
3. Give two examples of real habitual exercises.
4. Give two examples of real constructive exercises.
5. Classify real exercises.

Completion

1. The choice of real exercises lies with the . . .
2. Real exercises are . . . in themselves.

3. Real exercises possess the . . . that belongs to reality.
4. Real constructive exercises are those required for meeting . . . situations.
5. Once the exercise is chosen, the next step is the . . . of it.

Right or wrong?

1. Real exercises do not need to be practised.
2. Only practical exercises are real exercises.
3. Real exercises are not possible within the school.
4. Real exercises need not be corrected.
5. All real exercises are collective exercises.

ADDITIONAL QUESTIONS AND EXERCISES

1. Give several examples of the inability of pupils to apply to life facts learned in a subject in school.
2. Give five cases in which a person who knew a principle was unable to apply it.
3. Take such a principle as 'the volume of a cylinder is the product of the height into the area of the base', and make up two problems of a practical sort that should serve as exercises of application. Will these be real exercises?
4. Why is it difficult to use real exercises in school?
5. Are there any subjects in which formal application is sufficient?

CHAPTER XV

PROBLEMS AND PROJECTS

In this chapter we wish to examine the relation of the Problem and the Project Methods to the analysis of learning described in this book. The questions we have to answer are: do these new methods show the three phases of learning, viz., the acquisition, fixation and application of knowledge, and are they one-step, two-step or three-step learnings?

The word 'problem' has been long known to teachers of arithmetic, algebra and science. After teaching a certain number of rules or laws belonging to these sciences, it has always been the custom of teachers to set a number of problems to afford pupils an opportunity of using in a thoughtful way knowledge already acquired. The term 'project' was also first used to denote certain applications, such as raising a calf, connected with agricultural education. The problem and the project understood in this way are merely applications in two-step learning. It should be noted, however, that problems were generally formal while projects were from the beginning real applications.

Those terms began to assume a new meaning with John Dewey's emphasis on learning by doing. His followers, especially T. B. Kilpatrick and J. A. Stevenson, elevated the project from being an application to the status of a unit of work, the starting-point of

learning. In other words, work began with a project or problem instead of ending with them. A similar effort was made by C. A. McMurry to make the problem the unit of work. Kilpatrick emphasized the importance of real projects while McMurry did the same for large problems.

Building a seed store is an example of a project much used. The class makes a seed store of big blocks, boxes of seeds, labels for the different kinds of seeds, and baskets in which to gather the seeds. Another example is the actual cultivation of a paddy field. The pupils first find out all the processes involved in paddy cultivation and apply the methods thus discovered.

We shall quote here two examples of large geography problems suggested by McMurry.¹ They are:

A. New Orleans Problem :

1. To show the importance in the early history of America, of New Orleans as an outlet for the Mississippi River.
2. To make clear the importance of the steamboat as an aid to traffic on western rivers.
3. To show how the government has attempted to control the river waters by means by levees and jetties.
4. To show Captain Ead's plan for building the jetties.
5. To find out the importance of other good ports in comparison with New Orleans.

¹ C. A. McMurry, *Practical Teaching*.

B. The Panama Canal Problem :

1. To show the successes and failures of the earlier road- and canal-builders at Panama.
2. To discover how the United States took up the canal project and acquired the right to build a canal.
3. To show how the United States undertook the canal project and organized the work.

It will be seen from these examples that both projects and problems are large exercises which emphasize the importance of investigation.

These exercises may be regarded as units of work valuable in themselves giving rise to the second way of regarding projects and problems. Thus a seed store would be built because it is a good thing for the pupil to learn how to make a seed store. Similarly the Panama Canal would be studied because the pupil ought to know about it. When projects and problems are regarded in this way they are just one kind of unit of work, taught in a one-step method, as in their case the process of acquiring knowledge cannot be strictly separated from application. In a project the plan thought out at first may have to be rejected after trial. Projects and problems as ordinary units of work afford scope for independent investigation but the aspect of fixation tends to be neglected as we have already seen.

A third way of regarding problems and projects is to consider them as methods of teaching constructive application. By working upon large projects and problems which themselves involve invention, creation and discovery, the pupil is inspired to invent, create and discover for himself. When problems and projects are

treated in this way, the first problem or project is the means by which the pupil acquires knowledge of how to carry out large projects and problems, resembling those of real life. By doing further projects and problems he fixes and applies his knowledge. This method gives the pupil a training in invention, creation and discovery such as cannot be gained by only doing the small problems and projects associated with ordinary school teaching.

The fourth and last way of regarding projects and problems is the one adopted by the American reformers. All the work of the school must be centred round a big project, so that the school subjects instead of remaining in separate compartments become integrated. This is a wholesome protest against the 'water-tight system' of subjects. Specialist teachers, in particular, tend to keep their subjects within strict limits. The geography teacher, for instance, may consider that while teaching geography he has no time to spend on improving the pupils' English. This, of course, is wrong and the inter-relation of subjects must be kept in mind by every teacher. In other words every teacher should be ready to teach incidentally important matters not directly affecting his own subject. But this is quite different from asking that all other subjects should be made subordinate to one subject, either history or geography, as was done at one time. The proposal then was that all subjects should be taught incidentally except the chosen subject. The proposal now is to subordinate all subjects to one grand project or problem. Thus cultivation of a field may be taken as a project and arithmetic, history,

geography and literature taught incidentally as arising from the project. The chief objections to this plan are (a) correlation becomes extremely artificial and (b) the teacher's time tends to be spent in seeking correlations rather than in his legitimate work of teaching and (c) incidental teaching only of subjects does not ordinarily do sufficient justice to them. While granting that some degree of correlation is essential, very few teachers will agree to subordinating all subjects to one subject, project or problem.

Summary

This chapter may be summed up as follows: the first way of treating projects and problems is to use them as applications at the last phase of learning. This is the oldest method of using them. The second way of treating them is to begin teaching with them, that is, to regard them as units of work such as topics. The third way is to regard them as useful for developing real invention, creation, and discovery. This is done by enabling the pupil to practise large projects and problems which are more like real projects and problems than the small varieties at present practised in schools. The fourth and last way is to regard the problem or the project as the only possible unit of work and to teach all other subjects incidentally. This is to carry to an extreme the value of correlation.

QUESTIONS AND EXERCISES

1. What do you regard as the essential difference between a problem and a project?

2. Write out in your own words a definition of project teaching, noting its essential characteristics.
3. Make notes for a five-minute talk on 'Project teaching and the development of initiative and individuality'.
4. Write out a list of five practical projects for use in teaching your subject in your school, and describe in detail how you would carry one of them out.
5. What do you regard as the outstanding weakness or weaknesses of project teaching?
6. To what extent is it possible to employ project teaching in your subject?
7. Write out a list of 'don'ts' for project teaching.
8. Have you ever engaged in a project? If so, how was your central purpose formed?
9. Formulate three problems for your subject, around which the work of a class might centre for several days or more.
10. What are the advantages of emphasizing a problem-solving type of teaching?
11. What ways are there of learning generalizations, other than by deriving them as problems? What are the relative advantages and disadvantages of the problem-method of arriving at generalizations?
12. If it is objected that children will waste time if allowed to experiment on problems what will your answer be?
13. Make geography a theoretical centre of correlation and show what other subjects can be taught incidentally.
14. Explain the steps in project-teaching.
15. Give a short history of the project method.

CHAPTER XVI

CONCLUSION : THE THREE-PHASE THEORY

It is now time to summarize the contents of this book. We all know that in spite of all the labour spent in examining various aspects and details of teaching and in spite of the excellent literature that now exists on the teaching of the various subjects of the curriculum, teaching has remained empirical, lacking fundamental principles.

Various attempts have been made from time to time at discovering suitable principles. The following maxims are traditional :

Proceed from the known to the unknown.

Proceed from the concrete to the abstract.

Proceed from the empirical to the rational.

Proceed from the simple to the complex.

Proceed from the indefinite to the definite.

Correctly understood these maxims are of great value to the teacher but they afford him no basis for directing his work as a whole. They refer chiefly to the acquisition of knowledge only.

The first systematic attempt at providing a suitable theory for guiding teaching as a whole was made by Herbart. We have already described the 'formal steps' of his followers, and found that they were suitable only for lessons in which the pupil has to learn generaliza-

tions. Practical teachers discovered that these steps could not be used, except artificially for teaching skills and appreciations.

The last great attempt at providing a universal method was made by the adherents of the project method. According to them everything was to be taught by the project method. Anything that did not naturally fall into this method was somehow to be introduced into it by correlation. Fanciful correlations clearly showed that the project method did not fit all subjects or everything that had to be taught.

In this book we have developed a theory—which may be called the Three-Phase Theory—which we believe will provide the teacher with something like a rudder for guiding all his teaching. Whatever he undertakes to teach, skill, appreciation, comprehension, invention, creation or discovery, he will find the Three-Phase Theory both applicable and helpful.

The three phases are the acquisition, fixation and application of knowledge.

The acquisition of knowledge

That there is a phase of acquisition of knowledge in all learning has not always been clearly realized. This is partly on account of the restriction of the word knowledge to clear and distinct knowledge; in other words, to conscious knowledge. In information subjects such as history and geography it is clear to most people that conscious knowledge is involved and that there is a distinct phase of acquiring knowledge. It is not so clear at first sight to many people that to be able to do an

action one must know what to do. Unsophisticated people have no doubt at all that knowing is essential in such cases. The fact that in knowing how to do an action our knowledge is chiefly subconscious, has also made some people reluctant to admit a phase of acquisition of knowledge. There is, however, an additional reason. That is, that in learning a skill we do not usually begin with the acquisition of knowledge but with the application of past knowledge. We try to do the new thing and then acquire the knowledge necessary for doing it correctly. It is the fact that learning may begin with action or application instead of knowledge that has prevented many people from realizing the importance of acquisition of knowledge as a phase in the learning process. We conclude then that a phase of acquisition of knowledge is always involved in learning, though it is not always the first step of learning.

Knowledge is gained through experience, communication and investigation. These words may not be familiar to teachers, but the teaching devices that they use for producing knowledge are quite familiar to them. These are showing, telling and questioning. Showing helps the pupil to have experience, telling gives him communications to accept and questioning starts him on investigations, the results of which he can report.

Showing, telling and questioning may be used in combination as well as by themselves. The principle underlying the joint use of these devices is that one must be dominant. If the Demonstration Mode is most suitable for teaching something, then telling and questioning must be kept subordinate to showing. Thus, the

appropriate mode of teaching musical appreciation is the Demonstration Mode. The pupil must actually hear the pieces. Explanation and questioning must be kept subordinate to hearing.

For information lessons the appropriate mode is the Lecture Mode in which telling is dominant, but lectures may be supported by demonstrations and discussions. A history lecture which starts as a lecture and ends as a discussion is an example of bad side-tracking in teaching. A lecture during which discussion is permitted must end as a lecture.

In the case of problems and projects investigation is necessary and therefore the appropriate mode is the Discussion Mode in which the question device is dominant. Here too, the other devices may be helpful. Some things may be shown and other things told. To make either of these dominant will result in the pupil ceasing to investigate.

The notion of dominance is essential whenever the teacher decides to use more than one device for helping the pupil.

The fixation of knowledge

Recognition of the fact that learning involves a phase of fixation is much more universal than the recognition of acquisition of knowledge as a phase of learning.

Items of knowledge get fixed in two ways—through repetition and through organization by education, that is, by intelligent thinking. Referring to this phase of learning McDougall says,¹ 'I conclude, then, that there

¹ *Energies of Men*, p. 362

are two distinct types of learning-process: intelligent learning involving achievement through relevant insight, foresight and feeling; and unintelligent learning through mere repetition. And it would seem that very many actual instances of learning are of mixed type, the two processes being intimately blended in various proportions.' It is because of this intimate blending that there are two modes of helping the pupil to fix his knowledge. In the Drill Mode it is repetition that is dominant. In the Review Mode it is intelligent thinking or organization that is dominant. It is well to remember that because one device is dominant the other is not excluded. Repetition, for instance, is the aim of the Drill Mode but organization through intelligent understanding, of the multiplication table for example, need not be excluded.

The application of knowledge

This phase of learning has received much less recognition than either of the other phases. Application is an unfamiliar word to most teachers, although there has always been a good deal of application in the school. The device for causing the pupil to apply knowledge is the application exercise, a device that teachers of arithmetic and mathematics have always used. Yet its relation to learning is not clear to most teachers because, not recognizing that learning is the main business of the school, they have not sought to find the relation between teaching devices and learning processes.

Exercises and applications are of two kinds, formal

and real. The function of the former is to prepare for the latter. Many circumstances have conspired to make teachers forget the relation between formal and real application. Among them is the pressure of examinations, which usually test either the reproduction of knowledge or its formal application. Another is the isolation of the school from life. Still another cause is the time that real applications take. Teachers need to realize more fully than they do that the abilities acquired at school must be capable of being used in a real way. Such real use is not limited to 'practical' use but includes the ability to appreciate and comprehend.

Formal exercises and applications are of three kinds, substitute, partial and miniature. Substitute exercises such as verbal problems in arithmetic preserve only the form of real applications. Partial exercises involve the practising of parts of real exercises, while miniature exercises involve the practising of whole activities on a reduced scale.

Still another classification of applications is necessary before we can conclude this section. This is the division into habitual and constructive applications. By habitual applications we react to accustomed situations and by constructive applications we react to novel situations. Practice in reacting to novel situations is gained chiefly by doing problems and projects.

One other fact has to be noted about application. It is that knowledge does not necessarily of itself lead to application which is a form of action. A

person acts because he wants to or wills to act. Hence application cannot be secured without motivation.

It will be seen from this summary that the key to teaching is the clear understanding of the three phases of learning. With the Theory of Three Phases constantly at the back of his mind any teacher is in a position to raise his practice from the empirical to the rational stage.

The main facts discussed above may be diagrammatically shown as follows:

TEACHING		
<i>Phases</i>	<i>Modes</i>	<i>Crucial Processes</i>
1. Helping acquisition	1. Demonstration 2. Talk or Lecture 3. Discussion	1. Showing 2. Telling 3. Questioning
2. Helping fixation	1. Drill 2. Review	1. Fact questions 2. Thought questions
3. Helping application	1. Formal application 2. Real application	1. Practice and correction of formal exercises 2. Practice and correction of real exercises

APPENDIX A

PRACTICAL APPLICATION OF THE THREE-PHASE THEORY

Procedures

This appendix shows in outline the application of the Three-Phase Theory to the teaching of the following subjects in the primary school:

1. Adopted or foreign languages
2. The mother-tongue
3. Number
4. Literature
5. Geography
6. History
7. Science
8. Physical development
9. Art
10. Handwork

I. PROCEDURE IN THE TEACHING OF ADOPTED OR FOREIGN LANGUAGES IN THE PRIMARY CLASSES¹

I. Preparatory Stage

Aim: Ability to speak and to understand spoken language.

Procedure

A and B. ACQUISITION AND FIXATION

1. Free assimilation.
2. Pronunciation exercises.

¹ Prepared by H. S. Perera, M.A., Principal, Government Training College, Colombo.

3. Question drill.
4. Imperative drill.
5. Memorizing stories.

C. APPLICATION

1. Pupil gives commands already learnt or made up by him.
2. Pupil asks questions already learnt or made up by him.
3. Pupil relates stories memorized or made up by him.

11. Stage with Reader as Centre

Aim : Comprehending, speaking, reading and writing.

(i) Reading and Speech

Procedure

A and B. ACQUISITION AND FIXATION

1. Teacher reads text aloud with explanations where necessary. Explanations may also be given before and after. Pupils follow *without* books.
2. Pronunciation exercises based on text. Speech sounds, words and sentences.
3. Silent reading exercises. Pupils read text silently with a view to answering orally questions written on the board before or after the reading. A record should be kept of the improvement in speed.
4. Memorizing model sentences, especially those in which dialect forms are likely to occur, if constructed by the pupil unaided.

C. APPLICATION

1. Speech exercises. Questions on substance of text.

2. Grammatical and other exercises based on text.
3. Story-telling and lecturettes.
4. Oral reading exercises, including reading of selections from newspapers and journals.

(ii) Writing

Procedure

A and B. ACQUISITION AND FIXATION

1. Handwriting exercises: writing from models and transcription exercises. A record should be kept of the improvement in speed, after sufficient accuracy has been obtained.
2. Spelling and dictation exercises, including punctuation.

C. APPLICATION

1. Writing answers to questions on text.
2. Writing answers to grammatical and other exercises.
3. Letter writing.
4. Free composition including descriptions and stories.

II. PROCEDURE IN THE TEACHING OF THE MOTHER-TONGUE IN THE PRIMARY CLASSES¹

Procedure with Reader as Centre

(i) Reading and Speech

Aim : Improvement of ability to read and speak.

A and B. ACQUISITION AND FIXATION

1. Teacher reads text aloud with explanations: where necessary. Explanations may also.

¹ Prepared by H. S. Perera.

be given before and after. Pupils follow in reader.

2. Silent reading exercises. Pupils read text silently with a view to answering orally questions written on the board before or after the reading. A record should be kept of the improvement in speed.

C. APPLICATION

1. Speech exercises. Questions on substance of text.
2. Grammatical and other exercises based on text.
3. Story-telling and lecturettes.
4. Oral reading exercises, including selections from newspapers and journals.

(ii) Writing

Aim : Improvement of ability to write.

A and B. ACQUISITION AND FIXATION

1. Handwriting exercises: writing from models and transcription exercises. A record should be kept of the improvement in speed, after sufficient accuracy has been obtained.
2. Spelling and dictation exercises, including punctuation.
3. Grammatical exercises with special reference to the forms of the written language.

C. APPLICATION

1. Writing answers to questions on text.
2. Letter writing.
3. Free composition, including descriptions and stories.

III. PROCEDURE IN THE TEACHING OF NUMBER IN THE PRIMARY CLASSES¹

A. ACQUISITION

Aims: The work in primary classes is devoted to acquiring a ready knowledge of the following—accuracy and speed being the important parts of the aim.

1. Counting, writing and reading numbers.
2. Addition and subtraction combinations.
3. Multiplication and division combinations involving tables up to 12 times.
4. Learning the following tables and the application of the four rules to them :
 - (a) Local money, (b) Tables of length, weight, liquid and dry measures, time.
5. Vulgar and decimal fractions; and the application of the four rules referring to them.

Procedure

1. Use of concrete material for (a) counting, (b) building up notation, (c) building up money and other tables.

or

2. Use of bead frame for notation and for development of multiplication tables in simple language.

or

3. Reading and writing of numbers and tables.

B. FIXATION

1. Repetition of tables.
2. Rapid oral questioning, answers given orally.
3. Oral questions, answers to be written down by each child.

¹ Prepared by J. Bleakley, M.Sc., Vice-Principal, Government Training College, Colombo.

4. Speed exercises based on the four rules, in the form of practice cards on the lines of the Courtis practice tests.
5. Number games, preferably in form of cards so that each child does the work.

Note : Number games in which all the children take part together generally result in the work being done by a small part of class.

C. APPLICATION

1. Formal application exercises, the object of which is to familiarize children with the number combinations and tables.
2. Use of ruler in connexion with handwork.
3. (Measurement and weighing, where possible in relation to home life, in classroom.)
4. (Planning garden plots.)
5. (Shop games, specially applied to money table and its association with tables of length, etc.)

Note : Items in brackets need not be done daily.

IV. PROCEDURE IN THE TEACHING OF LITERATURE IN THE PRIMARY CLASSES¹

(i) *Appreciation*

A. ACQUISITION

(a) *Aim* : Paving the way for appreciation.

Procedure

1. Giving an appropriate setting to the selected piece of literature.
2. Working up anticipatory interest and providing a suitable approach.
3. Elimination of difficulties of comprehension.

¹ Prepared by R. A. Kriekenbeek, Lecturer in Literature, Government Training College, Colombo.

4. Presentation of the literature by the teacher's interpretative reading of it to the class.

(b) *Aim* : Deepening appreciation.

Procedure

1. Initiating a class discussion based on first impressions.
2. Guiding the discussion along channels that lead to the points of particular appeal.

B and C. FIXATION AND APPLICATION

Procedure

1. Indicating appreciation by 'expression' work or in words.
2. Memorizing the whole or parts of the selection.
3. Recitation by the pupils with adequate and intelligent expression of their appreciation.

(ii) *Creative work*

A. POETRY

1. Rhyme-making with single words.
2. Constructing lines with metrical rhythms.
3. Constructing alliterative lines.
4. Constructing couplets in verse.
5. Constructing 'four-line' stanzas.

B. PROSE

1. Constructing simple plots.
2. 'Characterization.'
3. Writing short stories embodying 1 and 2.
4. Writing little plays embodying 1 and 2.

V. PROCEDURE IN THE TEACHING OF GEOGRAPHY
IN THE PRIMARY CLASSES¹

(This procedure refers to the study of an entire topic or unit of work.)

¹ Prepared by S. F. de Silva, B.A., Lecturer in History and Geography, Government Training College, Colombo.

A. ACQUISITION OF KNOWLEDGE

Aims

1. To give the pupil a feeling of familiarity with the topic or unit of work.
2. To develop geographical skills, e.g. map-reading.

Procedure

1. *Pupils gather information by direct observation, e.g. visits to markets, etc.*
or
2. *Pupils examine pictures, models, etc.*
or
3. *Teacher supplies the necessary information by narration, etc.*
or
4. *Pupils with the aid of questions gather the information wanted from textbooks, or maps or the globe.*

B. FIXATION

Aim: To help the pupil to fix and organize knowledge acquired.

1. The teacher employs the device of 'rapid-fire' questions, or the pupils question each other.
2. Pupils make short speeches with the class as a critical audience.
3. Dramatization or presentation of tableaux by the pupils.
4. Map-making and map-reading exercises.
5. Pupils make models, draw pictures, etc., relevant to the topic selected.
6. Pupils make comparisons and contrasts of facts learnt.
7. Pupils make short summaries of knowledge acquired.

C. APPLICATION

Aim : To help the pupil to apply in relation to life the knowledge acquired.

Procedure

1. Making models, etc. for a school exhibition or class museum.
2. Writing short scenes, dialogues, etc. for class or school concert.
3. Organizing a tableau for a class or school concert.
4. Keeping a geography scrap book.
5. Making use of simple maps, e.g., road maps.
6. Encouraging pupils to take an interest in the geography of the school district, to observe on holiday trips how people live in different places, etc.
7. Encouraging pupils to think geographically by teaching them to ask themselves: 'How do people earn their livelihood?' 'How do they make use of things given by nature?', etc.

VI. PROCEDURE IN THE TEACHING OF HISTORY IN THE PRIMARY CLASSES¹

(This procedure refers to the study of an entire topic or unit of work.)

A. ACQUISITION OF KNOWLEDGE

Aims

1. To give the pupils a feeling of familiarity with the topic or unit of work selected.
2. To arouse an interest in the story of man.

¹ Prepared by S. F. de Silva.

Procedure

1. *Pupils visit museums or places of historic interest and record facts (direct observation).*
or
2. *Pupils examine pictures, models, etc. and thus gather information.*
or
3. *Teacher supplies the necessary information by narration, etc.*
or
4. *Pupils, with the aid of questions, find out from the class text the information required.*

B. FIXATION

Aim: To help the pupil to fix and organize knowledge.

1. The teacher employs the device of 'rapid-fire' questions or the pupils question each other, etc.
2. Pupils make short speeches to the class, which acts as a critical audience.
3. Pupils act a part of the story or present a tableau.
4. Pupils make models, draw pictures, construct picture charts, etc.
5. Pupils make a short summary of the facts gathered.
6. Pupils make comparisons and contrasts of facts learnt.
7. Pupils draw maps to show historical facts.

C. APPLICATION

Aim: To help the pupil to apply in relation to life the knowledge acquired.

Procedure

1. Making models, costumes of different historical periods, picture charts, etc. for a school exhibition or class museum.

2. Writing short historical plays or scenes, organizing a tableau for the school or class concerts.
3. Keeping a historical scrap book.
4. Making record and development charts with the help of which pupils organize their knowledge in graphic form on their own.
5. Encouraging pupils to take an interest in the history of the school district and the homeland, and to visit places of historic interest.
6. Encouraging pupils to think historically by teaching them to ask: 'How has this or that, come to be what it is today?'

VII. PROCEDURE IN THE TEACHING OF SCIENCE IN THE PRIMARY CLASSES¹

(This procedure refers to the study of an entire topic which will require two or more lessons.)

A. ACQUISITION

(a) *Aims*

1. To give pupils a feeling of familiarity with the topic and to establish a suitable background.
2. To give the teacher a *general* idea of the previous knowledge and interests of the pupils.

Procedure

1. *Either* pupils go on an excursion or ramble in order to examine the habitat and collect specimens: *or* the teacher exhibits the specimens that he has obtained and by discussion develops the correct background.
2. The teacher questions the class rapidly for a

¹ Prepared by E. C. T. Holsinger, B.Sc., Lecturer in Science, Government Training College, Colombo.

few minutes omitting the correction of erroneous answers.

(b) *Aim*: To encourage pupils to obtain first-hand information through careful observation and experiment.

Procedure

The teacher encourages careful observation by :

1. Distributing specimens evenly, demonstrating the correct handling of specimens, setting up suitable experiments, and arranging pupils in suitable groups when necessary.
2. Asking stimulating questions.
3. Requiring pupils to make models or drawings.
4. Requiring pupils to grow plants, rear small animals, and perform simple experiments.

B. FIXATION

Aim : To help the pupil to organize and fix his knowledge.

Procedure

The teacher

1. Asks questions which are arranged in logical order.
2. Supplements the information obtained by observation and experiment.
3. Helps pupils to write brief notes and make diagrammatic drawings.
4. Requires pupils to do suitable exercises.
5. (Organizes games.)
6. (Requires pupils to preserve specimens.)

C. APPLICATION

Aim : To apply the knowledge and skill acquired to the study of suitable objects and phenomena in the pupils' environment.

Procedure

The teacher stimulates the spirit of investigation by :

1. Helping the pupils to prepare a list of problems to be solved by them whenever convenient.
2. Suggesting methods for future work.
3. Providing a 'nature table' and giving the pupils opportunities for examining and discussing the specimens on it.
4. Encouraging pupils to keep a *nature calendar*.

Note : Items italicized are of special importance. Items in brackets will not be a constant feature of every lesson.

VIII. PROCEDURE IN THE TEACHING OF PHYSICAL DEVELOPMENT IN THE PRIMARY CLASSES

(i) *Health Habits*¹

(This procedure refers to the study of an entire topic which will require one or more lessons.)

A. ACQUISITION

(a) *Aims*

1. To give pupils a feeling of familiarity with the topic and to establish a suitable background.
2. To give the teacher a *general* idea of the previous knowledge of the pupils and their interest in practising the health habit appropriate to the topic.

Procedure : The teacher questions the class rapidly for a few minutes omitting the correction of erroneous answers. He may call upon one or more pupils to demonstrate to the class the particular manner in which they practise the health habit.

¹ Prepared by E. C. T. Holsinger.

(b) *Aim*: To amplify the knowledge that the pupils possess regarding the health habit and to demonstrate the most suitable way in which the health habit should be practised.

Procedure

1. The teacher demonstrates the health habit.
2. He asks stimulating questions in order to encourage the pupils to observe carefully his demonstration.

B and C. FIXATION AND APPLICATION

Aim: To help the pupil to organize and fix his knowledge in regard to the performance of the health habit. To establish the health habit personality.

Procedure

1. The teacher asks questions in order to fix the correct sequence of the operations involved in performing the health habit.
2. Some pupils imitate the teacher's demonstration.
3. The teacher helps pupils to write brief notes (and to make health charts).
4. (He organizes games in order to facilitate and encourage the performance of the health habit.)
5. (He reads a story about the health habit.)
6. During the course of the daily inspection of pupils the teacher makes certain that the pupils have practised the health habit.
7. (He organizes a system for awarding marks, badges, etc., in order to encourage pupils to practise the health habit consistently.)

Note: Items in brackets will not be constant features of every lesson.

(ii) *Physical Training*¹*Aims*

1. To create an interest in physical training.
2. To help children to acquire the skills necessary for good carriage and for good posture.
3. To help children to gain the benefits of physical exercise.

Procedure

1. Introductory exercises: (a) Free exercises, e.g. marching, running, skipping, jumping, etc.; (b) head exercises, arm exercises, leg exercises, free breathing exercises.
2. Trunk exercises.
3. Balance exercises—breathing exercises—controlled.
4. Shoulder-blade exercises.
5. Abdominal exercises.
6. Jumping or general activity exercises. Breathing exercises
7. Games, skipping with ropes, or country dancing. Breathing exercises.

IX PROCEDURE IN THE TEACHING OF ART
IN THE PRIMARY CLASSES²*Aims*

1. To prepare the mind of the pupil to appreciate the beauty in things.
2. To put in the hands of the pupil the power (technical skill, up to a degree) to represent faithfully what he sees.

¹ Prepared by Miss N. G. Perera, Government Training College, Colombo.

² Prepared by T. U. de Silva, Lecturer in Art and Handwork, Government Training College, Colombo.

3. To develop imaginative drawings, and provide suitable opportunities for free graphic expression.

A. ACQUISITION

Procedure

1. Initiating class discussion and leading from first impressions to the observation of details—in form, colour, etc.
2. Guiding the children to represent, as faithfully as they can, things beautiful in form and colour. Leading them to acquire a control of the mediums used.
3. Demonstrations by the teacher of specific methods of applying the mediums, and imitation by the children.
4. Free imaginative drawing by children of objects and illustrations of stories, etc. Class discussion and individual correction by teacher.

B and C. FIXATION AND APPLICATION

Procedure

1. Free expression in making small pictures with the types of drawing done—objects in groups or singly—small scenes—illustration of ideas (stories, etc.) through pictures.
2. Advancing appreciation (a) by collecting, and suitably mounting small pictures, (b) by discussions on the beauty of collected pictures, designs, etc.
3. Making simple articles and decorating them suitably. (This is best done in co-ordination with the craft work of the class.)
4. Making diagrams and illustrations in connexion with after-school activities.

X. PROCEDURE IN THE TEACHING OF HANDWORK IN THE PRIMARY CLASSES¹

Aims

1. To provide pupils with opportunities for using their hands skilfully.
2. To develop a sense of 'thought and action' through planning, and through the actual making of things.
3. To develop manual dexterity.
4. To provide opportunities for designing, decorating and appreciating good craftsmanship.
5. To provide an avenue for expressing ideas in association with other school subjects.

A. ACQUISITION

Procedure

1. Pupils gather ideas of construction through direct observation (i.e., analysing the construction of articles, etc.) or through the instructions of the teacher or through discussion or through diagrams and plans.
2. Pupils make models and acquire knowledge of how to manipulate tools and to control the mediums used.

B. FIXATION

Procedure

1. Helping pupils to organize their knowledge by questioning, by experiment, and by diagrammatic drawings (plans).
2. Setting pupils suitable practice exercises.

¹ Prepared by T. U. de Silva.

C. APPLICATION

Procedure

The making of decorative and useful articles :

(a) by copying (habitual application)

(b) by invention (constructive application).

APPENDIX B.

TESTING

IN the educational world there is at present a great deal of discussion with reference to tests. Most teachers have heard of New Type tests and of the condemnation of the traditional Essay Type tests. Some of them may also have heard of a well-known book called *An Examination of Examinations*¹ which has aroused a great deal of controversy.

In this appendix it is proposed to discuss why tests are necessary, the chief types of tests and their essential qualities, and the chief testing procedures. Such a treatment, it is hoped, will enable the teacher to take a critical view of the New Type tests, to take a similar view in regard to Essay Type tests, and, in general, to make a rational application of the principles underlying testing.

Purposes of tests

In the real world tests are in continual use for various purposes. Before a driving licence can be granted, a person must pass a test. Before oranges can be graded in regard to quality, they must be tested. Before a person can be admitted into government service, among other things his health must be tested. A test is an examination or trial. The results of a test may be expressed quantitatively or qualitatively. A patient's temperature may be tested and the result expressed quantitatively, as so many degrees. Apples may be examined and divided into grades or quality such as grade A, grade B and grade C. In the former case

¹ By Sir Philip Hartog and E. C. Rhodes, 2nd ed., 1936 (Macmillan.)

there is measurement with a definite unit. In the latter case there is an estimate rather than a measurement.

The results of teaching have to be tested both quantitatively and qualitatively. Some features admit of quantitative measurement while others do not. It is possible, for instance, to count the number of sums a pupil is successful in working, but it is not possible to count his degree of appreciation of literature.

Tests are required in education for (a) diagnosis and (b) promotions and certificates.

The first of these purposes is diagnosis. This is necessary because the teacher needs to know from time to time how the pupil is getting on. With large classes it is impossible for the teacher to become sufficiently acquainted with each pupil so as to be able to diagnose his difficulties. He will not know the individual deficiencies and superiorities of his pupils unless he frequently tests them. Without testing he cannot do any remedial teaching. No adequate knowledge of whether the pupil has progressed satisfactorily through each phase of learning is possible without the help of tests. Hence testing, informal or formal, is a constant accompaniment of teaching.

The second purpose of testing is to secure data for promotions and leaving certificates. This is a duty that all teachers have to face. It will be seen later that the kind of tests suitable for this purpose are not the same as those suitable for diagnosis. But before we discuss tests we may note that it has been the custom to secure the necessary data for promotions and leaving certificates by means of a final examination alone. It is generally agreed nowadays, however, that the data afforded by final examinations should be supplemented by data from term examinations and teachers' estimates. The best authorities consider that the final examination

should count not more than half and not less than one-third towards the final result.

Types of tests

The first division of tests is into composite and partial. Most abilities are composite abilities and are analysable into simpler abilities. Thus ability to do simultaneous equations is a composite ability analysable into such simpler abilities as ability to remove fractions, ability to remove brackets, ability to add, ability to subtract, etc. Similarly ability to write an essay is analysable into such abilities as ability to write letters and symbols, ability to punctuate, ability to make an outline, etc. In the same way ability to speak is analysable into ability to pronounce vowels, ability to pronounce consonants, ability to stress words and sentences, and ability to utter sentences fluently and with correct intonation.

Partial tests, that is tests of component abilities, are necessary for diagnostic purposes and every teacher should know how to prepare them and also have a collection of them. Examples of such tests are the following:

1. Courtis Tests of adding, subtracting, multiplying and dividing.
2. Reading words such as the following as a partial test or reading.

dig	card	jack
dog	cart	back
dug	Carl	sack

Tests may also be complete or sample tests. A test is complete if all the components of an ability are tested. It is a sample test if only a part of the ability is tested and that part is taken as representative of the whole. Thus the ability to pronounce vowels is completely tested if the pupil is made to pronounce all the vowels. If a judgement on the pupil's ability to pronounce vowels is

made on the testing of a few vowels, then the test is a sample test.

It is obvious that only the simpler abilities can be tested completely. Most abilities are so complex that only samples can be conveniently tested. Thus the ability to add the first thousand numbers can only be tested by the sample method.

Since most tests have to be sample tests, the teacher should know how to make samples as representative as possible of the whole. The first thing necessary to do is to divide into sections the field within which the ability operates. Thus ability to add the first thousand numbers may be divided into ability to add single numbers, double numbers and numbers of three figures, and additions involving carrying over. Similarly to test geographical ability it is necessary to divide the field of geography into physical features, climate, productions, occupations and means of communication, etc. After the most important divisions have been made and important questions prepared, the next step is to choose at random from each division. Random choosing is necessary when there is a number of questions of equal importance from which a choice has to be made. The next step is to make sure that the tests are neither too easy nor too difficult, and the last step is to make sure that there is a sufficient number of samples to afford the pupil adequate opportunity for exhibiting his ability.

Another very important division of tests is into direct and substitute. In direct testing the ability itself is tested and in substitute testing it is a related ability that is tested. A very good example of substitute testing, though not from school work, is the testing of temperature with the help of a thermometer. Here what is actually tested is the height of a column of mercury and the results are applied to temperature. This is a valid test since there is a necessary connexion between

temperature and the rise of a column of mercury under certain conditions.

Substitute tests are extensively used in education. These are of two kinds, information or memory tests, and paper problems.

In history, geography and literature many tests demand the reproduction of information. For example,

What do you know of the ministry of Walpole?

Name three islands in the Mediterranean.

Give an account of the plot of Shakespeare's *King Lear*.

The teacher must know how valid information tests are. Obviously one must reproduce knowledge before one can apply it, but unfortunately reproduction does not guarantee application. For diagnosing a pupil's ability information tests are necessary but for testing for promotion and leaving certificates they should be sparingly used, since in such examinations it is the composite real abilities that need testing.

The second kind of substitute test is the paper problem in which application is also required. Examples are the testing of arithmetical ability by means of paper problems, handwork ability by a paper on handwork, and geographical ability by a paper on geography.

In judging how valid paper problems are we have to distinguish between habitual abilities and constructive abilities. Habitual abilities require very little thinking while constructive abilities require much. It therefore follows that problems cannot be used at all in testing habitual abilities. These must be directly tested. Handwriting, reading, handwork, and drawing have to be directly tested. In the case of all constructive abilities, however, thinking precedes action. The portion that is concerned with thinking may therefore be validly tested on paper, but of course the test is incomplete, unless the action itself is also

tested. It may therefore be concluded that the degree of validity that attaches to a paper problem test is that which belongs to a partial test.

There is another division of tests which is of special importance. This is the division of tests into set or formal tests and informal tests.

A set or formal test is a test in which the pupil does a prearranged piece of work especially for test purposes. A set handwriting test is one in which a pupil writes a number of lines, knowing that a judgement would be made on those lines. An informal test of handwriting takes place if one examines the exercise books of the pupil and bases his judgement on samples not specially written for testing. Speech may be tested formally by asking the pupil to make a speech on which he knows he will be judged. It can be tested informally when the pupil speaks and is unaware of the fact that he is being tested.

The great disadvantage of a set test is that the pupil's performance becomes unreal and is therefore not truly representative of his usual ability. It is well known that a pupil may do very well at a set handwriting test, and yet write very badly on ordinary occasions. Its good feature is that the pupil is not taken at a disadvantage.

The chief objection to informal testing is that the examiner may be biassed if he does not know or does not disclose the items on which his judgement is based. For instance, he may unconsciously base his judgement on the appearance of the pupil. It also usually involves a subjective judgement. There is also the temptation not to examine sufficient samples. The validity of the informal test is high but its reliability is small.

Qualities of tests

The essential qualities of tests may be summed up in the two words, validity and reliability (consistency).

'Valid' means 'true' and a test is valid only if it truly measures what we wish to measure.

The meaning of validity will become clearer if we examine the conditions that make tests invalid or untrue.

The first condition that makes a test invalid is when there is absence of correspondence between the aims of teaching a subject and the test. It is possible to set a purely memory test, say, in geography. To most modern teachers such a test would not be a valid test because they hold that the aim of geography teaching is to enable a pupil to make real use of his knowledge.

In regard to the aims of teaching many subjects there is uncertainty among teachers. The more the uncertainty the less they can ensure validity. In some subjects such as literature even if the aims are definite it is difficult to find tests that will measure the abilities desired. A recent invention in the field of literature is the Paired Comparisons test, in which the pupil is asked to compare two selections and to express his judgement.

An example is the following :—

- 1(a) Earth has not anything to show more fair;
Dull would he be of soul who could pass by
A sight so touching in its majesty.
- 1(b) Earth has nothing to show more fair;
He would be dull of soul who could pass by
A sight, in its majesty, so touching.

In testing ideals and the character aspect of the pupil only a beginning has been made in the invention of valid tests.

Uncertainty as to the aims of teaching is the chief cause of invalidity but there are also other causes. A sample test, for instance, would be invalid if the sample is not representative of the whole. Catch questions, puzzles, and exceptions are examples of samples which are not representative of the whole. Insufficient sampling is another cause of invalidity. Substitute tests are valid,

as we have seen, only as partial tests. They cannot be regarded as completely valid tests. Set or formal tests do not ordinarily test actual habitual abilities. Although they cannot be used for testing habitual abilities they are valid as partial tests of constructive abilities. Tests also become invalid if the examiner marks on items not covered by the labels. Thus marking for handwriting in a geography test tends to make the test invalid as a geography test. If it is desired to test handwriting as well a separate mark should be given for it.

It is necessary that tests should be as valid or true as possible but uncertainty as to the aims of teaching and ignorance of the conditions of validity have led to a state of affairs in which validity has not received due attention.

The second essential quality of a test is its reliability or consistency.

-Just as validity is the agreement of measurements with the things measured, so reliability is the agreement between any two independent sets of measurements of the same set of things. In other words reliability is the dependability of a test. If the same test is set twice or is set by different examiners, will it give the same results? If it does, it is a reliable test. It gives consistent results.

There are many causes that lead to low reliability. One of these is the variability of human abilities. A physical thing, like a wall, remains the same however many times we may measure it, but human abilities tend to change with each measurement. Variability may also be due to external conditions such as weather, health, or excitement. Extensive sampling may overcome some of these difficulties. A second cause of unreliability is subjective marking. It has been shown in *An Examination of Examinations* as well as by psychologists that there is extraordinary variability in the marks given by

different examiners or by the same examiner at different times to answers to questions of the essay type. It is claimed by some that the variability is so great that Essay Type tests should not be used. Others maintain that with trained examiners the variability is within reasonable limits. To overcome variability, New Type tests, such as 'yes' and 'no' tests and completion tests have been invented which can be marked objectively. These objective tests, it is generally admitted, increase reliability or consistency at the expense of validity. Whenever we find bad agreement between different measurements, then we can safely say that the examination is bad. But when the measurements agree, we *cannot* say that the examination is good. Thus in geography we can set a perfectly reliable test by asking only memory questions but hardly any one would agree that the test is a valid geography test. It must not be supposed that all New Type tests are reproduction tests. Intelligence tests are mostly of the new type, but they are generally not reproduction tests. Whether subjects taught in the best modern ways can be satisfactorily tested only by objective tests is a controversial question. The balance of opinion seems to be on the negative side.

Reliability is secured by reducing the variability of abilities and making tests objective. But reliability or consistency is only one of the essential characteristics of good tests. To it must be added validity.

Test procedures

From the point of view of procedure, tests may be divided into three kinds:—

- (a) Performance tests
- (b) Essay Type tests
- (c) New Type tests.

Performance tests require the pupil to carry out

some action, while in Essay Type and New Type tests he is required to express his thoughts in words.

Performance tests are necessary for the direct testing of all habitual abilities, manual or verbal. Ability to make a table can only be directly tested by action. It cannot be directly tested by asking the pupil to express his thoughts about the making of a table. Similarly handwriting can only be tested by taking samples of handwriting.

Performance can be best tested directly and in an informal manner. A set test, as we have seen, tends to make a performance unreal. It is also important that there should be a sufficient number of samples. Thus handwriting cannot be adequately tested with the help of one or two samples. Bias must be guarded against by making clear to oneself what is being judged.

Reliability or consistency can be increased by taking certain samples as standards. In interviewing this is called the 'man to man comparison' method. It consists in definitely regarding certain people as possessing the required quality, say, in high degree, medium degree and in low degree. All others are then compared with these fixed standards. Ordinary performances may also be judged in a similar manner. Thus handwriting may be judged by means of a handwriting scale, and handwork by suitable standard samples.

The second procedure in testing is to require the pupil to express his thoughts in essay form. The great objection to these Essay Type tests is their unreliability. Reduction of unreliability may be attempted on the same principle, as in man to man comparison, by choosing certain essays as standards. In connexion with Essay Type tests the distinction between scores and grades is of great importance. Scores merely indicate the number of correct answers. Grades imply comparison with a standard. Thus in a given test an examiner

may regard 33 right out of 100 as a pass mark and 75 as a credit mark. In another test the marks may have to be different for pass and credit. Since both scores and grades may be expressed numerically, these two matters tend to be confused by examiners. Some examiners first score; that is, find the number right and then convert the scores into grades fixed by themselves or by an authority such as the education department. In the sorting method of marking there is no scoring at all. This method consists in sorting out the answers into, say, five grades. To increase reliability each lot should be re-examined, and re-adjustments should be made, if necessary.

The validity of Essay Type tests may be increased by securing their correspondence with the aims of teaching. Reproduction or memory tests may be of the essay type and are useful for diagnostic purposes. For other purposes they are useful as partial tests of constructive abilities. They are valid tests only of the thinking necessary for constructive or original abilities.

The third procedure used in testing calls for short answers to New Type tests. The following are examples:—

1. Enumeration tests; for example:

Name three islands in the Mediterranean Sea.

2. Completion tests; for example:

The English general, and the
French general were both
killed in taking Quebec.

(The testee has to fill in the blanks.)

3. Right or Wrong tests in which the pupil has to write 'yes' or 'no' against each answer; for example:

Did the French lose all their possessions in
America as a result of the French and Indian
War?

4. Association tests or matching tests in which the

pupil has to join by a line the related items in two columns of items ; for example :

A	B
London	Spain
Colombo	England
Pittsburg	United States
Paris	Ceylon
Madrid	France

5. Reasoning tests ; for example .

Make a mark against the best reason.

Why do we buy clocks ?

Because

1. We like to hear them strike.
2. They have hands.
3. They tell us the time.

New Type tests as we have already seen have a high degree of reliability. (It may be remarked in passing that 'yes and no' tests have to be marked right minus wrong to make allowance for guessing.) The problem in regard to New Type tests is how to increase their validity. Some New Type tests, such as enumeration tests, are reproduction tests and they should only be used when reproduction is desired. Other tests may involve either reproduction or education and thinking. Thus a completion test may be so constructed as to make reproduction alone necessary or to make education essential. Whenever we desire to make use of New Type tests for testing the power of thinking in any given material, the tests must be made as educative as possible. Such construction requires careful thought.

New Type tests of the reproduction type have only the degree of validity that belongs to substitute tests. They are also partial tests. New Type tests of the educative type have the same kind of validity as Essay Type tests. This, however, is a controversial point. It

is maintained by some that the New Type tests even though they be of an eductive type do not give the same scope for free thinking as Essay Type tests. It has to be granted that the construction of New Type tests that require thought is much more difficult than the construction of Essay Type tests.

A teacher requires to use tests of all three kinds. Many kinds of work done in schools nowadays require performance tests. Skill and appreciation can only be tested in this way. For the testing of knowledge and thinking power we have Essay Type tests and New Type tests. The former tend to have greater validity than the latter but less reliability or consistency.

Conclusion

The uses that the teacher can make of this discussion of tests may be put in the form of maxims as follows:

1. Distinguish between tests for diagnosis and those for promotion.
2. Use not only Essay Type and New Type tests but also tests of performance.
3. Regard Essay Type tests as only partial tests of constructive abilities.
4. Distinguish between scores and grades.
5. Use New Type tests chiefly when you wish to test information for diagnostic purposes.
6. For promotion purposes use informal tests as well as set tests, taking care to avoid bias.
7. When testing informally see that you examine sufficient samples.
8. To ensure validity make sure that the test is a test of what you really wish to test.
9. To ensure reliability use objective tests.

10. When objective tests are not suitable, use the 'man to man comparison' method.
11. When using substitute tests remember that they are substitutes.
12. Use partial tests when you wish to diagnose the abilities of your pupils.
13. See that samples are sufficient in number and representative of the whole field.
14. Remember that tests suitable for diagnosis are not always suitable as promotion tests.
15. Make sure you know the advantages and disadvantages of different kinds of tests.

EXERCISES AND QUESTIONS FOR DISCUSSION

1. Distinguish between achievement and diagnostic tests.
2. Under what conditions, if any, are unannounced written tests justifiable? What are the arguments for and against unannounced tests?
3. Point out how the scoring of thought questions and problems can be made more objective?
4. Frame an indictment either for or against the essay type of examination.
5. Frame an indictment either for or against the short-answer type of examination.
6. What do reliability and validity mean in relation to educational measurements?
7. What are the values of and objections to informal estimates of class work? How and when should these estimates be made?
8. What is meant by the 'subjectivity' of teacher's marks?
9. Explain the technique for making, giving and scoring true-false tests.
10. How much weight should be assigned to the different factors that enter into making up a pupil's final mark?
11. Compile a list of the technical words relating to educational measurements which have been used in this chapter.
12. Prepare a summary of this chapter.

13. What is substitute measurement? Explain how substitute measurement may produce a change in the immediate aims of students.
14. Will an objective test necessarily yield reliable 'measures'? Will it yield valid measures? Give your reasons.
15. Teachers sometimes ask what should be the passing mark: should it be 60, 70, 75 or some other grade on a scale of 100? How would you answer such a question?
16. Distinguish between a score and a grade.
17. Compile a list of different kinds of objective tests.
18. Prepare a list of different types of essay questions.
19. Should a pupil's promotion be determined solely by his marks in examinations?
20. What precautions should be taken to secure reliable 'sampling' in an information test?

APPENDIX C

PSYCHOLOGICAL ANALYSIS OF THE MODES OF ACQUIRING KNOWLEDGE

THE modes of acquiring knowledge are psychologically not simple processes. They are complex operations which are analysable into simpler processes. If we can make a successful analysis, we shall be able to find out the simple process or processes that are crucial in each mode of acquiring knowledge, and then by concentrating on them, gain greater control of each mode.

Before we can analyse any complex action, we have to agree on what the elementary processes are into which it may be divided. So it is with the modes of acquiring knowledge. In this matter the school of psychology that offers us the greatest help is the London School, which we shall mainly follow.

Spearman, the well-known founder of the school, has proved that there are three ultimate processes as far as generation of knowledge is concerned.

Apprehension of experience

The first of these is apprehension of the nature of lived experience. The law underlying this has been stated as follows: 'A person tends to know his own sensations, feelings and strivings.'¹ It is by this process that we become aware, for instance, of the

¹ C. Spearman : *Creative Mind*, p. 15 (C. U. P. and Nisbet). The more exact formula given in his *Nature of Intelligence*, 2nd ed., 1927, p. 48 (Macmillan) is: 'Any lived experience tends to evoke immediately a knowing of its own characters and experiences.'

characters of sense-experiences. It is only by undergoing experience that we can become aware of colours such as blue and red, of sounds such as noises and tones, and all the other qualities obtained by the help of our sense-organs. Sensory experiences not only convey to us qualities but also enable us to apprehend quality, spatiality and temporality. When we see colour it has not only a certain quality, but also a certain intensity. In addition colour is seen as extended in space. It has also a temporal quality being seen at a point of time. Sounds similarly have quality, intensity and temporality but little spatiality. It is true that we become aware of the voluminousness of sounds and of their direction, but their total spatiality is not equal to that of visual objects.

We apprehend the characters not only of sense-experiences but also of all other mental experiences such as feelings, emotions and wants.

Eduction

The second and third ultimate processes are of an educative nature. By eduction is meant a drawing out of knowledge from data already given. These two processes are the eduction of relations and the eduction of correlates.

The law of relation-eduction has been stated as follows: 'When two or more items (percepts or ideas) are given, a person may perceive them to be in various ways related.'¹

The following are examples: the relation of possessing attributes that exist between objects and their

¹ Spearman : *Creative Mind*, p. 18. His own more accurate statement is as follows :—'The presenting of any two or more characters (simple or complex) tends to evoke immediately a knowing of relations between them.'

attributes, the relation of identity between a man seen yesterday and the same man seen today; the relation of time between two events, the relation of distance between two trees, the relation of cause between pushing and falling, the relation of constitution between the parts of a table and the table itself, the psychological relation between mental objects and the knower, the relation of similarity between different human beings, the relation of conjunction between 2 and 3 in $2+3=5$, and the relation of evidence between the premises and the conclusion of an argument. These examples also show the chief classes of relations that may be educed.

More than one relation may be educed at the same moment. Two books may be seen to be not only near each other but also to be similar to each other. Two tones may be known to be identical in pitch but different in timbre. Further relations may be seen between relations. Two distances, for example, may be seen to be unequal. This involves first coming to know certain relations, namely, the distances and then a further relation, namely, their inequality.

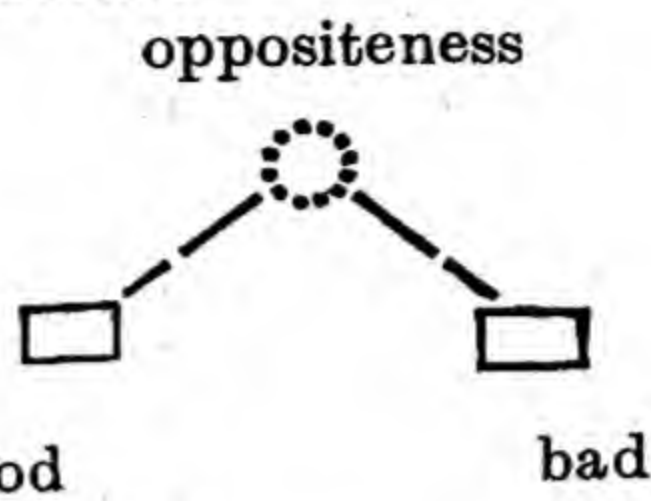
The law of correlate-eduction has been stated as follows: 'When any item and a relation to it are present to mind, then the mind can generate in itself another item so related.'¹

The following are examples; Being given a note and the relation of the fifth, the musically gifted can immediately become aware of the fifth. Given one line and the relation of equality, we can think of a line equal to the given line. Given the premises of an argument we can think of the conclusion.

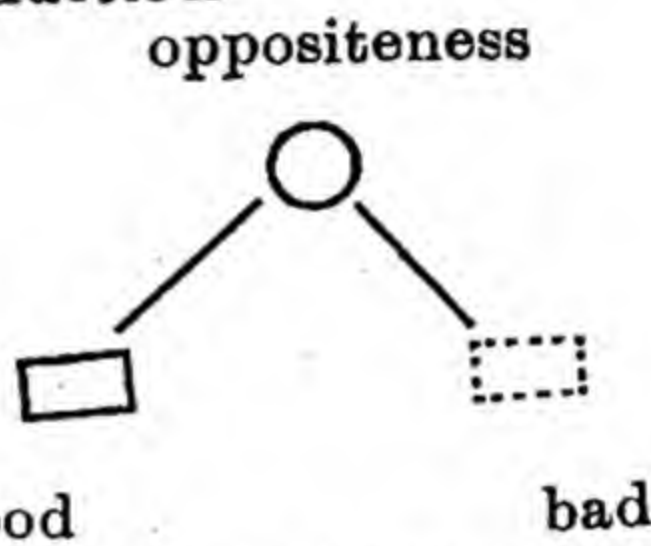
¹ Spearman: *Creative Mind*, p. 23. His own more exact statement is as follows:—'The presenting of any character together with any relation or relative character tends to evoke immediately a knowing of the correlative character.'

The two processes of eduction have been diagrammatically represented by Professor Spearman¹ as follows:

(a) Relation-eduction



(b) Correlate-eduction



In these figures, objects are represented by rectangles and relations by circles, given items by lines and educed items by dotted lines. In (a) the relation of oppositeness that is educed, is represented by a dotted circle. In (b) the correlate 'bad' that is educed, is represented by a dotted rectangle.

Deduction and induction

The logical processes of deduction and induction which play a great part in higher learning are cases of correlate-eduction. The reader will find a full discussion of them in Chapters xvii and xviii of Spearman's *The Nature of Intelligence and the Principles of Cognition*.² Here we shall content ourselves with illustrating the two operations.

¹ *Creative Mind*, p.23.

² Macmillan.

As an example of deduction we may take the following syllogism:

All men are mortal.

John is a man

Therefore John is mortal.

Here the first two propositions form the given item and the given relation is 'therefore' and the educed correlate is the last proposition.

As an example of induction we may consider how the universal proposition 'All men are mortal' has been derived. Following Spearman we may state the argument as follows:

Whatever happens without exception, will continue to happen. Men have died without exception. Therefore all men are mortal, i.e., will die.

Here of the two propositions that form the given item the first is a proposition that we have accepted and the second is derived from observation. These two propositions together with the given relation 'therefore' enable us to educe as a correlate the last proposition.

Apprehension of experience, eduction of relations and correlates are processes by which new knowledge is generated. Knowledge already obtained may be recalled by the process of reproduction especially by contiguity and similarity which we have already explained.

Acceptance

Yet another process, this time of a volitional nature must be mentioned before we can proceed to the analysis of the various modes of acquiring knowledge. This is the volitional process of accepting knowledge. When someone tells us that London is the capital of England we accept the statement. Similarly we accept such statements as 'The world is round' and 'William the Conqueror invaded England'. This is not a process by

which any new knowledge is generated. It is a process by which information is accepted from others.

We have now a list of elementary processes.

They are :—

1. Apprehension of experience.
2. Education of relations and correlates.
3. Reproduction.
4. Accepting information.

Analysis

Having this list we are now in a position to make a psychological analysis of the modes of acquiring knowledge with a view to discovering crucial processes.

The first mode is acquiring knowledge through experience. As an example for analysis we may take coming to know a flower through experience. In the total knowledge acquired we may distinguish among others the following :—

- (a) Apprehending the sensory characters of the flower, e.g. the colour red and its intensity ; apprehending the pleasure of seeing the flower and perhaps the desire to touch it.
- (b) The various parts of the flower are seen in various relations to each other and also as constituting one flower. These relations are educed implicitly without any conscious effort.
- (c) Reproduction of past experience of this flower together with any information we may possess in regard to this kind of flower.
- (d) A final process by which the past knowledge is made to fit into the present experience through correlate-education.

This mode of acquiring knowledge is distinguished from all other modes by its emphasis on the apprehension of experience. This then is the crucial process in this

mode. To make sure of this emphasis the learner must take a passive attitude allowing the experience to have its full effect. Further the conditions necessary for successful sensory experience must also be present. The flower, for example, must be in a position in which it can be easily seen. To ensure full enjoyment the setting in which the flower is placed must also be satisfactory. In the comprehension of a flower this stage takes very little time, but in the appreciation of a picture or a poem the emphasis on this stage has to be very much greater.

The second mode of acquiring knowledge is through accepting communications. We may take as the example for analysis the further development of the knowledge of a flower through accepting information. If this mode is adopted, we may be shown the various parts of the flower and be told their names and their functions. In this process we may distinguish among others the following:—

- (a) Associating new words with meanings given in experience and reproducing the meanings of familiar words.
- (b) Constituting the meanings of the separate words into one whole through implicit education.
- (c) Accepting information.

The last, accepting information, is, of course, the crucial process in this mode of acquiring knowledge. The principal conditions under which information will be accepted have been already discussed. They are (a) congruence with past experience and (b) prestige. Ordinarily the prestige that normally attaches to teachers is sufficient to induce us to accept information offered by them. To facilitate acceptance it is necessary that the words used by the teacher should be already known. If new words are used by the teacher they should be immediately explained or illustrated. It is also necessary

that information should be given in orderly fashion if a satisfactory understanding of meanings is to take place.

The last mode of acquiring knowledge is through investigation. We may take as our example the last stage in the development of the knowledge of the flower. The usual plan is to make the pupil investigate a flower. In this process we may distinguish among others the following:—

- (a) Apprehension of the sensory characters of the flower.
- (b) Reproduction of past experience and of information gained through communication.
- (c) Conscious eduction of relations and correlates on the data supplied by experience and information with consequent systematization of knowledge. The system would include generalizations of an inductive nature, if a number of flowers had also been examined.

In this mode of acquiring knowledge the crucial process is the last one—conscious eduction of relations and correlates. For success in the operation we have already found that the learner must take an active attitude so that he is searching for knowledge instead of passively awaiting it. On starting his quest he must have some definite problem that he wishes to solve, so that his search will be a conscious one. The exclusion of emotion will be a prominent characteristic of this process since emotion tends to bias observation. The result of the process will be the building up of a system of knowledge, including both facts and generalizations.

Summary

Apprehension of experience, eduction of relations and correlates, reproduction and accepting information are the elementary processes into which the modes of acquiring knowledge may be analysed. In all the

modes all the elementary processes may occur. The modes are distinguished from each other by the emphasis each puts on a particular elementary process. Acquiring knowledge through experience is characterized by the predominant part that apprehension of experience plays in it. The essential process in acquiring knowledge through communication is the process of accepting information, which itself depends upon the reproduction or revival of the meanings of words, while in acquiring knowledge through investigation the leading part is played by eduction.

QUESTIONS AND EXERCISES

Enumeration

1. Name the processes by which new knowledge is generated.
2. Of what nature is the process by which we accept information?
3. Classify eductions.
4. Show diagrammatically how systematized knowledge is obtained.
5. Show diagrammatically the two kinds of eduction.

Completion

1. Acceptance depends upon congruence with past experience and . . .
2. Lived experience tends to give rise to awareness of its . . .
3. The presenting of two or more items tends to give rise to awareness of a . . . between them.
4. The presenting of an item together with a relation tends to give rise to awareness of the . . . item.
5. Deduction and induction are cases of . . .

Right or wrong?

1. Only one relation can be educed at a time.
2. Spatiality does not belong to auditory objects.
3. The crucial process in learning by investigation is eduction.
4. By eduction is meant a drawing out of knowledge from data already given.
5. The relation of cause exists between a picture and its colour.
6. Relations may be seen between relations.

7. That all men are mortal is an example of deduction.
8. The modes of acquiring knowledge are elementary processes.
9. Systematic knowledge is gained by eduction.
10. Satisfactory knowledge can be gained through experience alone.

ADDITIONAL QUESTIONS AND EXERCISES

1. How many particular cases does one usually examine before forming a generalization?
2. What is the difference in one's attitude towards the generalization sought in induction and the one used in deduction?
3. What is eduction?
4. Explain knowledge by acquaintance.

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